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THE DIALECTIC OF PRACTICE AND THE LOGICAL STRUCTURE OF THE TOOL

PHILOSOPHY, ARCHAEOLOGY AND THE ANTHROPOLOGY OF TECHNOLOGY

Jannis Kozatsas

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Introduction

Questions relating to technology make up one of the most discussed and widely investigated areas of archaeological and anthropological research today. In recent decades, the theoretical study of technology has been significantly advanced by the introduction of new investigative techniques, the development of interdisciplinary studies, and by a series of epistemological shifts (Gosselain 1992: 559; Sillar and Tite 2000; Stark 1999: 25). Nevertheless, throughout much of the twentieth century, most notably in the English-speaking Western world, technology played a marginal role in both disciplines despite the best efforts of neo-positivistic trends like 'New Archaeology' raising important questions about the production and use of material culture. By the late 1980s, the state of research was described paradigmatically by a comment from P. Lemonnier in response to a recently-published article by B. Pfaffenberger (1988): "to read about technology in an English-speaking anthropological journal is a sort of an event" (Lemonnier 1989: 526). Today, we can assert that in both archaeology and anthropology, the holistic treatment of technology as a multidimensional form of social practice that considers tools, raw materials, gesture sequences, embodied expressions, energy fluxes, natural forces, structured environments, cognitions, personal intentions, social needs, social relations, and cultural values (cf. Dobres 1999, 2000; Gosselain 2011a; Lemonnier 1992, 1993a; Sillar and Tite 2000), has at its disposal a broad and well-defined theoretical agenda, as well as a steadily growing empirical record.

Over the last three decades, both in Western archaeology and anthropology, a significant shift has occurred that has led to the recognition of technology as a critical issue, thereby establishing new agendas for research (Cresswell 1996; Dobres 1999, 2000; Ingold 2000, 2013; Latour and Lemonnier 1994; Lemonnier 1993b; Pfaffenberger 1992, 1999; Stark 1998a). This change has been neither unconditioned nor abrupt. On the contrary, it has stemmed from a series of intellectual developments that took place over the course of the late twentieth century and the beginning of the new millennium, altering the epistemological consciousness of the field. Two major factors have motivated current debates on the anthropology of technology: first, the diffusion of the French anthropological tradition into English-speaking academia; and second, the breaking down of the idealism of post-processual tradition into more phenomenological approaches — a process that endeavours to place greater emphasis on the material aspects of material culture. At the same time, broader developments from the 1980s onwards, including the advance of the philosophy of technology from a marginal topic of modern epistemology into a major academic field through the formation of Science and Technology

Studies (STS), have contributed to the creation of a vivid intellectual milieu that has forced the question of technology to the front line of contemporary debates. This theoretical shift in archaeology and anthropology has therefore transformed — as every genuine epistemological shift — the questions to be posed, the puzzles to be solved, and the prospects to be explored.

Current trends in French and American anthropology have placed explicit emphasis on the social grounding and cultural configuration of technological systems, which have aimed to re-conceptualise technology as a form of social practice (Dobres 1999, 2000; Lemonnier 1992, 1993a; Pfaffenberger 1992, 1999). Contrary to neo-positivistic thinking, technology tends to be understood as a dynamic field wherein the technical logic — considered as a kind of materially and physically-determined rationality — is profoundly interwoven with socio-cultural elements (Gosselain 2000). As I will argue in the following sections of this book, instead of the *analytic dualism* of the older processualism — a framework that kept the subject and the object apart from each other — the new approach adopts a kind of *synthetic dualism*, a method that allows for the subject and the object to be intrinsically connected in the technical practice itself. Despite their differences regarding the question of whether the technical and the non-technical (i.e., socio-cultural) dimensions of technology can actually be separated from each other, both currents have yet to effectively overcome the dualistic treatment of material culture, insofar as they admit that objective rationality and socio-cultural aspects must not be reduced on each other.

At the same time, contemporary "symmetrical" archaeologies and anthropologies of material culture have considered a parallel theoretical agenda, levelling substantial criticism against modern and post-modern dualism, and arguing for a radically monistic conception according to which any ontological differentiation between subjects and objects should be effectively discarded. Practical activity is thus understood as a unified "field of forces" or as a "seamless web" of ontologically indivisible variables. If French and American anthropologists have underlined the indispensable role of human culture in the articulation of technology, phenomenological approaches have stressed the need for a return from "anthropocentrism" (Knappett and Malafouris 2008: IX) to the "materiality" of material culture (e.g., DeMarrais *et al.* 2004; Ingold 2007, 2013; Knappett 2005; Meskell 2005a; Miller 2005a; Olsen 2010). The new "monism" of the symmetrical approaches is significantly different to earlier (as well as contemporary) analytically and synthetically dualistic views: it does not seek to find a way of bridging the gap between the subject and the object, i.e., between the socio-cultural sphere and the field of nature; it does not aim to reconcile the opposites, to make them compatible with each other through a unifying conception, but rather discards any ontological difference

as a bare axiomatic, non-justified (moreover, non-justifiable) presupposition that imposes an alien ontological character on the reality. Drawing both on early twentieth century phenomenological approaches and late twentieth century philosophy of science and technology, symmetrical approaches have proposed a new conception of technology and material culture with strong constructivist tenets.

Given this theoretical kaleidoscope of modern archaeological and anthropological understanding of technology, a sharp dichotomy has become obvious: on the one hand, dualistic approaches are striving to explain the way that two *ex hypothesi* ontologically different variables (the subject and the object or the socio-cultural and the natural) meet within material processes; on the other hand, recent monistic approaches are striving to create a cohesive theoretical reconstruction of the way that the *ex hypothesi* unified (uniform and singular) field of reality (or of the "Being") develops. It is apparent that, on a meta-theoretical level, a new, radical opposition (a new form of meta-theoretical "dualism") immediately arises: dualism vs. monism. Indeed, it is this opposition between dualistic and monistic ontologies that gives rise to a new set of theoretical asymmetries regarding the beings and the phenomena of the world, and the ways in which they relate to each other.

Consequently, the question regarding the possibility of an alternative approach that might be able to overcome this new emerging opposition can hardly be avoided: is it possible to conceive technology (namely, material culture and human practice) in such a way that would neither absolutise the subject-object opposition nor eliminate it by postulating an equally axiomatic monism? In the course of this book, I argue that modern dialectical tradition, as developed by G.W.F. Hegel in the early nineteenth century, deals with exactly the same problem of going beyond both dogmatic dualism and dogmatic monism, i.e., of conceiving reality (or "Being") neither as primordially fractured or divided nor as originally singular and uniform, but rather as *originally united* not despite but due to the inherent, active, contradictory opposition of the subject and the object. As I further emphasise, although a theory of technology *per se* has never concerned Hegel himself and although there is today only a handful of general discussions on how Hegel could be read as a theorist of technology, there is still an unexploited pool of ideas that have seldom been taken into serious consideration, either by the philosophy or the anthropology of technology. Hegel's reflections on the ontological and epistemological character of *practical activity*, including a series of early notes on the concept of the *tool*, represent a set of theoretical positions that open up the possibility of an alternative understanding of technology; an understanding that could overcome the opposition between dogmatic dualism and dogmatic monism.

This book comprises three major parts. In the first, I present a brief critical review of the current thinking in theoretical archaeology and anthropology, focussing on the conception of technology. Starting with the refutation of processual or neo-positivistic analytic dualism, I argue that neither synthetic approaches nor phenomenological monism can form logically viable alternatives for understanding the dynamics of technology, either as an anthropological phenomenon or as a form of material social practice. Synthetic conceptions do not go beyond dualism insofar as the subject and the object are presupposed as actual substances before their synthetisation; while phenomenological monism leads to the annihilation of the ontological integrity of the elements involved, and deprives the creative dynamism of human-thing relationships.

Following the critique of the theoretical premises and the epistemological consequences of modern archaeological and anthropological theories of technology, in the second part of the book I propose an alternative dialectical theoretical framework for understanding technology as a material social practice within which the natural and the socio-cultural can be conceived as neither externally synthesised nor ontologically liquidated. More precisely, I investigate the possibility of reframing the concept of technology through Hegel's concept of practice, according to which, the subject and the object are produced immanently in the technological process as mutually mediated and inter-constituted elements. Technology is thus considered as a self-mediating totality that can be structured around the mutual practical constitution of subject and object as *interrelational entities* and *unified opposites*. My argument is based on the reconstruction of a set of theoretical positions elaborated on by G.W.F. Hegel and other Hegel-inspired traditions of nineteenth and twentieth centuries, and explores the potential of classical dialectics for a productive understanding of technology beyond all forms of dualism and dogmatic monism.

In the third part, I focus on the presentation and interpretation of Hegel's conception of the logical structure and role of the tool in technological practice. According to Hegel, the tool represents an immanent element and a structural moment of technological practice, capable of revealing its concrete articulation. After a brief critical consideration of Heidegger's view on the tool concept, I undertake a detailed reconstruction of Hegel's approach as delivered through his early philosophical writings. Following Hegel, a tool is not a neutral means for transmitting subjective ends to an external object. Instead, it reveals the relational ontology of technological practice. Far from being a mere *thing*, a tool expresses the general form of the practical relationship between the subject and the object; the materialisation of the inherent unification of the natural and the socio-cultural within the technical activity itself. The concept of the tool renders explicit the mutual constitution and inherent unity

of the subject and the object as negatively interrelated beings, essentially, as relational entities generated within practice. Hegel's anatomy of the logical structure of the tool makes up a unique, though mostly ignored, theoretical model in the history of ideas. Ultimately, it can contribute to the re-imagining of the theoretical maxims of the contemporary anthropology of technology, and re-state the nature of humans' social relationship with nature and the world of material culture.

PART I

A Brief History of Research: From neo-positivism to phenomenology and beyond

We often believe that the archaeological and anthropological study of technology is a recent phenomenon. While the most vivid theoretical debates on the question of technology have taken place in more recent decades, the study of technology has, in fact, been at the centre of research in both fields since the nineteenth century (Hicks, 2010: 30–35; Stark, 1998b: 3). Its decline can be traced to the beginning of the twentieth century when archaeology and anthropology in the West shifted towards functionalism, structural-functionalism, and a general discourse of "material culture" instead of "technology" (Hicks 2010: 36–38; Pfaffenberger 1999: 147). According to Pfaffenberger, the disregard for technology from an anthropological perspective was an immediate result of Malinowski's belief that the study of technology as a stand-alone subject was an "intellectually sterile" enterprise (Pfaffenberger 1999: 147). While this perspective became dominant in the English-speaking Western world, French sociologists and anthropologists laid the foundations for a new cultural anthropology of technology (e.g., Mauss 2007 [1967]; cf. Haudricourt 1987; Schlanger 2006), which viewed technical process as a phenomenon that is conditioned and, in turn, refracts the totality of socio-cultural relationships. This school of thought flourished in France in the second half of the twentieth century and reinforced a series of theoretical shifts that took place, most notably in the United States of America, at the end of the century.

In the case of archaeology, the beginning of the twentieth century was the time when the field met its first epistemological turn — if not its first theoretical formation — under the paradigm of *historical-cultural theory*, initially propounded by G. Kossina (1911, 1934 [1926]) and further developed in a more historical and materialistic form by V.G. Childe (e.g., 1925, 1929; for further discussion, see Trigger 1980, 2005: 163–174). Emphasis on the exhaustive genealogical classification of artefacts as the basis for differentiating distinctive *ethnic-cultural groups* could hardly provide an interpretative framework for those material aspects of life that had to do with ancient production techniques and their anthropological context. Even when technology was taken into account, it was often reduced to the mere classification of *tools*, thus detached from the real social processes of their production and use (see *e.g.*, Childe

1944). If today the concept of technology usually refers to the totality of embodied techniques, the design processes, materials involved, and the tools used for the production of material culture (together with the socio-cultural context into which these elements are articulated), in the case of the early discourses, technology was immediately reduced to the formal characteristics of the tools themselves. Technology was equated with the tools, and even production techniques were forced to the margins of any discussion of material culture.

It cannot be denied that Childe, under the influence of the Marxist tradition that placed emphasis on the means of production as indicators and mediators of social progress, underlined the importance of technology in the investigation of past societies. Technology and technological progress, however, were to be understood from a naturalistic, functionalistic, and evolutionary perspective. Thus, for Childe, tools were seen as subjective inventions that provided a solution to the deficiencies and limitations of human physiology (Childe 1958 [1936]: 45), being analogous to the body parts of animals (limbs, teeth, etc.), thereby enabling people to fulfil their needs (Childe 1944: 2). Moreover, in Childe's view, tools were "developed by a long process of gradual cumulative improvement from much simpler and less efficient implements" (Childe 1944: 1). At the same time, he saw them as "applications of contemporary knowledge or science existing when they were fashioned" (Childe 1958 [1936]: 13) or "the measure of the scientific knowledge" of a certain historical period (Childe 1958 [1936]: 34). Such views presupposed the sharp division between theory and practice, and furthered the presence of a sphere of pure knowledge even in those societies that offered no evidence for any modern division between pure thinking, which accurately *designs* a form-to-be-realised, and practical application.

On the other hand, Childe did explicitly link technology with society and economy — specifically the organisation of production, the division of labour, and social relationships. As the most durable technological objects that enter the archaeological record, tools could be understood as valuable indicators for understanding past socio-economic systems. For Childe, tools were facilitated by the economy and they respectively acted on it (Childe 1958 [1936]: 35–36). In this view, "any tool is a social product" bearing "the stamp [...] of the very different social and economic organisations under which [...] [it was] first made and used" (Childe 1944: 1; cf. Childe 1958 [1936]: 13, 34–35). Nevertheless, Childe's reflections did not lead to the articulation of a concrete analytical methodology for approaching technology and interpreting it within the archaeological record. This task was later undertaken by L.R. Binford (1965) and further developed by the work of other processual archaeologists. Over time, many of Childe's invaluable insights concerning the relationships

between economy, society, and culture with technology (i.e., with the tools and techniques developed by a certain socio-economic formation), were weakened and finally sacrificed to the formalism of mere typological classification. Moreover, even when Childe linked tools to the most general economical and social forms, he abstracted them from their specific cultural grounding as things that were charged with cultural meanings and values. The development of a sociological or anthropological theory of technology was yet to come about.

I.1 Elusive technology and analytic dualism: between processual objectivism and post-processual idealism

Apart from a few exceptions, questions relating to technology began to be posed in a systematic way from the 1960s onwards (e.g., Finley 1965), when Western archaeology underwent a substantial epistemological turn. In an attempt to form a more socially-based conception of the past, one capable of embracing the totality of human activity, this turn called into question the conceptual schemata of the historical-cultural tradition. Archaeology's "loss of innocence", according to D. Clarke's (1973) graphic formulation, led to an explicit "self-reflected turn" (Wylie, 2002: 107), which forced archaeologists to realise "the underlying logic of their discipline" (Renfrew and Bahn 2005: X), and re-state the concerns and objectives of their research. The so-called "new" or "processual" archaeology, inspired by the ideas of late neo-positivism, especially the falsification theory of Karl Popper and the hypothetico-deductive model of Carl Hempel (Binford 1968; cf. Bell 1994: 125–128; Krieger 2012; Wylie 2002: 1–22), placed special emphasis on the *production* and *use* of material culture, and thereby on the concept of *technology*. Binford was the first archaeologist to attribute a discrete functional role to the technological sphere through the division of material culture into three distinctive classes of artefacts: technomic, sociotechnic, and ideotechnic; each one fulfilling a unique role within the system of society and its subsystems. Among the three, *technomic* artefacts were recognised to be at the critical interface between *society* and *nature*, "having their primary functional context in coping directly with the physical environment" (Binford 1962: 219). In contrast to the other classes, which seemed to draw on the subjective aspects of societies (e.g., institutions and symbolic systems), *technomic artefacts* were explicitly attributed to the sphere of objectivity (as represented by *nature*) and linked to an objective rationality. As such, we consider neither the "social system" *per se* nor the "ideological rationalizations" and the "symbolic milieu in which individuals are encultured" (Binford 1962: 219). To the contrary, technomic artefacts are correlated with "environmental variables", and any "variability in the technomic components of archaeological assemblages is

seen as primarily explicable in the ecological frame of reference" (Binford 1962: 219). When archaeology investigates technomic artefacts, it has to be concerned exclusively with issues such as "extractive efficiency, efficiency in performing bio-compensatory tasks, [...] the nature of available resources" (Binford 1962: 219). In this scenario, technology is seen by Binford as an objectively constituted system that is driven by the principle of optimisation and efficiency within a given framework of natural resources.

Nevertheless, several scholars have argued that, contrary to the attribution of such a crucial role to artefacts directly involved in technological processes, including tools and material equipment, processual archaeology never developed a real theoretical debate on technology and did not attempt to refine its conceptual schemata (cf. Dobres 2000; Lemonnier 1989, 1993a; Pfaffenberger 1992, 1999; Stark 1998b; van der Leeuw 1993). The radical dichotomy between nature and culture, the detachment of the functional core of technological objects from their broader social grounding (political, aesthetic, ethical, etc.), and the de-socialisation of technology through the attribution of its development to an environmentally determined and, therefore, a-historical, non-human causality, scuttled the discussion of technology on a theoretically-confined level.

The field of ceramic studies has been one of the main areas where the study of technology has seriously challenged the explanatory dynamics of the different ecological, functional, and behavioural approaches that have otherwise flourished within the theoretical framework of processual archaeology (e.g., Arnold 1985, 2011; Kingery 1984; Matson 1965; Rice 1996a, 1996b, 1999; Rye 1981; Shepard 1976; Steponaitis 1984; Schiffer *et al.* 1994, 2001; Skibo and Schiffer 2008). Firmly grounded neo-positivistic models dominated the field of ceramic studies for a long time, even after the attacks they received from the post-processual critique (Gosselain 1998: 78). In the framework of New Archaeology, the basic research agendas were oriented towards a quest for those environmentally determined needs, demands, potentials and constraints that dictated, within the necessity of natural law, specific technical choices in the production process (Arnold 1985, 1999, 2008). As long as a correlation between a certain environment and specific technical behaviours was verified, this correlation could be generalised and raised to the status of a cross-cultural, behavioural, adaptive-evolutionary law. As D. Arnold declared: "Since the ecological approach to ceramics is basically etic and thus cross-cultural in nature [...], it is possible to compare the ceramic-environmental relationships in many societies and develop a set of generalizations about them which could apply to the past as well as to the present" (Arnold 1985: 14; cf. Schiffer 1976). In other words, the aim of archaeology is to find those "cross-cultural generalizations" that concern "the relationships of ceramics to the

environment and the rest of culture" and, further, provide "an understanding of these relationships in space before the variable of time is added" (Arnold 1985: 15).

Following Binford's fundamental distinction between the *technical* and the *design* dimensions of material culture (Binford 1965: 206), the dissociation of the functional aspects of artefacts from their non-functional uses prevailed within archaeological research for several decades. Binford drew, explicitly or implicitly, on analytical divisions of material culture — many of them already proposed by archaeologists of his time, although in the context of the historical-cultural tradition. For example, I. Rouse (1960) had proposed a distinction between "procedural" and "conceptual modes of classification" of artefacts, i.e., a distinction between the way that an artefact is practically (technologically) manufactured and the way it is determined by its maker's subjective ideas, expressed in the "design". V.G. Childe had previously pointed out in 1956 that "an archaeological type is defined for descriptive purposes by technique and form", while it can be further seen as a "vehicle for decoration" (Childe 1956: 36). Although Binford only explicitly refers to the work of I. Rouse as an immediate source for his own divisions of material culture (Binford 1965: 205), the similarity of his analytical divisions with Childe's distinction between "technique", "form", and "decoration" is striking. Nevertheless, regardless of the direct or indirect influences on Binford's 'New Archaeology', the most important point is that by the 1960s, archaeology could be discerned by an already deep-rooted belief that material culture had an inherent analyticity regarding its technological and morphostylistic dimensions.

Within the field of ceramic studies, this dominant dichotomy was transcribed in the form of a rigid distinction between *function* and *style* (Dunnell 1978; see also Meltzer 1981 in reference to lithics; for a more moderated version of Dunnell's model, see Shennan and Wilkinson 2002; for an evolutionary approach that is alternative to Dunnell's model, see Ames 1996; for an overview, see Hegmon 1992). Since *style* was considered to approach *non-functional* ends, like the transmission of *information* (about ethnic identity, social relations, and cultural values) (cf. Wobst 1977; Childs 1990; Neff 2014; for an attempt at a behavioural foundation, see Wiessner 1984; for an overview of the discussion, see Hurt and Rakita 2001) — *technique*, as the most material aspect of the objects, was linked directly to *functional*, *utilitarian* purposes (cf. Gosselain 2008, 2011b: 243). This "fracture of pottery" (Kiriatzi 2000: 9), the division between *utility* and *style*, became the concrete equivalent to the fundamental distinction between *nature* and *culture*, a distinction that penetrated the neo-positivistic dualistic worldview (Gosselain 1998: 79).

For the dominant trend of *ceramic ecology*, the appearance, development, and dissemination of pottery represented an idiosyncratic product of environmental and evolutionarily-determined human needs (Arnold 1985; Neff 1992; O'Brien *et al.* 1994; Steponaitis 1984; for an overview, see Loney 2000). However, such a perception transformed technology into an entirely *non-social phenomenon* which, according to what Pfaffenberger (1992) described as "the standard view" (cf. Dobres 2000: 31–35), belonged to the sphere of *nature* rather than society and culture. If "necessity" as an aftermath of man's effort to adapt to its environment is "the mother of invention" (Pfaffenberger 1992: 495; cf. Dobres 2000: 51 ff.), there can only be *natural* determinants and constraints that govern this peculiar phenomenon called "technology" (Gosselain 2011b: 243). As Gosselain has critically pointed out: "confronted with such a number of constraints, potters are left with little room for expressing their identity or for meeting non-technical, non-functional concerns. All they can do is to find materials and processing techniques that fit the Laws of Nature, and hence, to follow predetermined paths" (Gosselain 1998: 80). In practice, subjects are transformed from active agents and producers of technology and material culture into *objects*, i.e., mere *acts of nature*, simple products of the potentialities, the needs, and the overlaying laws (cf. Dobres 2000: 41 ff.). In this scenario, society is itself finally transformed into *nature*. The reduction is completed.

After 20 years of domination, processual archaeology started experiencing a series of de-constructing critiques from the early 1980s onwards. In archaeology, a new trend was formed, inspired by continental structuralism, post-structuralism, hermeneutics, and post-modern relativism, usually labelled as "interpretive" or "post-processual" archaeology (Hodder 1982, 1991b; Shanks and Hodder 1995; Shanks and Tilley 1987a, 1987b, 1989). Enthusiasm for this new trend, however, never effectively overcame the *analytic dualism* of earlier processual theory. Instead, it turned the direction of the theoretical interest away from the objectivistic empiricism of processualism, which emphasised the role of ecological determinants and objective rationality, and the collection of objective empirical data, its analysis and the generalisation of the results through a combination of deductively guiding hypotheses and inductively verifying results, to a subjectivistic, idealistic empiricism that highlights the empirical subject and its mental capacity to impose meanings on a meaningless material substratum. From this perspective, matter remained a passive bearer of the subjective meaning rather than an active constituent that participates in the generation of meaning. Post-processual archaeologists understood, therefore, much like Geertz, that culture, in the strictest sense of the term, is merely a set of mental or ideological, and thereby utterly subjectively spun "webs of significance" (Geertz 1973: 5), which are independent of the

materialities involved and the material processes that take place in societies. As N. Boivin argued: "The focus on *meaning* in archaeological interpretation, far from dispensing with the dichotomies that post-processualists aimed to break down, has in fact actually reinforced them. The eternal duality [...] between the material and the ideal continuous for the most part to be played out, and all that has really happened is that the focus has shifted from one side of the opposition to the other" (Boivin 2004: 63).

As an outcome, while post-processual archaeology created a vivid critical milieu and posed substantial questions for archaeological theory, it hardly ever dealt with the question of technology. Its strong idealistic orientation, the emphasis on the subjectivity of meaning, and the perception of material culture solely as "a medium of symbolic expression" (Dietler and Herbich 1998: 243) left scanty room for considering technology as a discrete category of social practice. If material culture is no more than a *text* that can be read and re-read (Hodder 1991b; Tilley 2015), then what belongs to matter itself and what concerns the material engagement of people and things can hardly be significant for the hermeneutic uptake of material culture. Both *matter* and the *material production processes* became elusive for the post-processual approach, which tended to reduce the sum of material culture to its subjective, ideological apprehension in terms of a *non-material meaning*. The subjective mechanism of meaning-giving was detached from materiality, became unconstrained and unconditioned by material factors, and recognised as capable of imbuing symbolic-conceptual attributes to the inert, passive material world (Boivin 2004: 63–64; Olsen 2010: 84). As a consequence, this privileging of the *subjective* inevitably led to the ignorance of technology.[2]

I.2 French and American anthropology of technology: synthetic dualism and the concept of the "process"

A renewed theoretical interest in technology was motivated in the late twentieth century by the slow transmission of the French anthropological tradition to English-speaking academia. An open meeting of the two traditions resulted in the subject-defining publication, *Technological choices*, by P. Lemonnier in 1993, followed by *De la préhistoire aux missiles balistiques* by B. Latour and P. Lemonnier a year later. These initiatives laid the foundations for the formation of a vivid dialogical framework that reshaped the questions concerning technology and material culture in contemporary archaeological and anthropological thought.

[2] Nevertheless, it is worth noting that Hodder emphasised the relevance of technological discussions, developed mainly in the French archaeological and anthropological literature, for post-processual, interpretive archaeology (see Hodder 1990).

From M. Mauss and A. Leroi-Gourhan to A.-G. Haudricourt, F. Sigaut or the group of the renowned journal, *Technique et Culture* (cf. Gosselain 2011b: 245–246; Lemonnier 2010), the theoretical thought of French archaeologists and anthropologists remained for the English-speaking world either fragmentarily perceived or completely unknown (Coupaye and Douny 2009). Apparent linguistic barriers (Stark 1998b: 6–7; cf. Lemonnier 1989: 526), rooted in broader historical, cultural, political, and intellectual differences between "continental" Europe and the "Anglo-Saxon" Western world prevented the systematic theoretical communication between French- and English-speaking archaeologists and anthropologists throughout much of the twentieth century. Though it condemned many scholars to simply "reinvent the wheel", as P. Lemonnier bitingly noted (Lemonnier 1989: 526), the lack of communication should be construed within the broader intellectual framework of English-speaking academia, which, for much of the twentieth century, was dominated by the ideas of neo-positivism and logical empiricism (cf. Wylie 2002), and thus posed a different set of questions regarding society and material culture. The transmission of an essentially different theoretical tradition, like the French one, which put at the core of its interests the social and cultural dimension of human practice and did not simply strive to reduce human behaviour on abstractly conceived objective determinants, like natural resources, environmental conditions, material properties, and biological needs, could not have taken place within the epistemologically incompatible theoretical framework of English-speaking archaeology and anthropology. The two traditions not only had different methodologies for studying material culture, but also different theoretical interests, ontological assumptions, and research questions. Therefore, the communication between the two perspectives was not solely prevented by the lack of "translations" of the French literature into English, as M. Stark argued (Stark 1998: 7). Moreover, the presence of translations of seminal works could not have prevented "the *style vs. function* debate altogether" in American archaeology and anthropology (Stark 1998b: 7), insofar as the foundational belief of this school of thought was the rigid analytical division between the *natural* and *cultural* dimensions of material culture – the first pertaining to the technology and practical utilisation of artefacts and the second belonging to the ideological (*i.e.* symbolical, meaningful, informational) aspects of social life. In the ontological universe of the French school, it was impossible to isolate these two aspects of material culture and to find either meaningless technologies or non-technically performed socio-cultural meanings.

The prelude to the fortuitous meeting between the two traditions, which took place with the above-mentioned collective bands by P. Lemonnier and B. Latour, was a series of internal theoretical developments that took place,

notably in the USA, in the second half of the twentieth century. From the 1970s onwards, American archaeologists and anthropologists had started to challenge the hard-core positivism of processual archaeology and the dualistic contradistinction of functional and symbolic aspects of material culture. Although this debate did not focus exclusively on the technological phenomenon *per se*, the challenging of the central division between *function* and *style* raised critical interest in the production processes of material culture, which inevitably involved the question of technology (Gosselain 1992). The result led to the formation of a modern American tradition with strong sociological concerns for technology. The meeting of French with American anthropology forced the anthropological theory of technology to move from *analytic dualism* of the past to a new *synthetic dualism*, a quasi-Kantian conception of nature and culture as inseparable constituents of technological practice (cf. Coupaye 2015).

With on-going field projects and new theoretical schemes derived from the French sociological, anthropological and archaeological traditions of É. Durkheim, M. Mauss, A. Leroi-Gourhan, and P. Bourdieu (Choleva 2018; Dietler and Herbich 1998; Gosselain 1992), as well from critiques of dualism that drew on Heidegger's phenomenology (Dobres 1999, 2000), technology started to be conceived not as an autonomous sphere of *objective rationality* based on the dictates of the nomological, deterministic normality of nature, but as a complex, socio-cultural phenomenon (Dobres and Hoffman 1994: 212; Hodder 1990; Lemonnier 1986, 1993a). The understanding of technology as a "total social fact" established the theoretical core for several anthropological approaches to technology as a socially and culturally grounded phenomenon (Gosselain 1998: 78, 2000; Lemonnier 1993a; Pfaffenberger 1988; van der Leeuw 1993), as a "dynamic act of material and social transformation" (Dobres 1999: 128), and as a social, sensual, embodied, and meaning-imbued action (Dobres 2000: 61, 96) through which *social identities* and the notion of the personhood are produced (Dobres 1999: 129). Instead of understanding human agency as a kind of "noise" (Dobres 2000: 38) that disturbs the allegedly objective technological rationality, there is an "holistic and subject-oriented approach to technology [...], which foregrounds social relations and agency" (Dobres 2000: 100).

Nonetheless, this emphasis on the social character of technology never led to a consideration of it as deriving unilaterally from culturally-imbued social choices abstracted from material needs, conditions, and constraints (Gosselain 1998: 78, 2011b: 251; Lemonnier 1993a: 23–24). Technology is a social phenomenon, but it is not socially "constructed" in the strictest sense of the term. On a methodological level, the emphasis on the social dimension of technology does not force one to ignore its materiality and to underestimate the

need for its *concrete empirical detection* (Dobres and Hoffman 1994: 214). In turn, the recognition of the materiality of technology "in no way renders it less social, cultural or human" (Schlanger 1994: 144). Rather "the production of matter and the production of meaning are co-incidental" (Schlanger 1994: 144). The essence of technology lies in the *co-operation* of the social and the material within the *technical practice* itself. According to Pfaffenberger, who employed a Marxian "catchphrase", technology "discloses man's mode of dealing with nature" (Pfaffenberger 1988: 236). It is a "social construction of the nature around us and within us, and once achieved, it expresses an embedded social vision" (Pfaffenberger 1988: 244). Technology is thus neither contrasted with society nor perceived as subsumed by the social. For Pfaffenberger, society and technology are instead conceived as inter-penetrating and reciprocally formed entities. Technology, as an equally material and socio-cultural event, is brought forth only within a broader organic totality, within a "sociotechnical system" (Pfaffenberger 1992). Society is nothing more than the outcome of the formation of complex sociotechnical systems and *not* their autonomous active cause (as the constructivist approach would stress) (Pfaffenberger 1992: 500). Social constructivism develops the same logical problems as ecological reductionism: both perspectives are abstract and thus only partial, and they fail to explain the relationship between society and nature *as* a relationship, i.e., without breaking it by abstracting one element for the sake of the other. Thus, as society represents only an *abstraction* from this totality, insofar as the cultural *meaning* is produced in inseparable correlation with the technical process itself, "no anthropology of symbolism can exist without an anthropology of technology" (Pfaffenberger 2001: 80).

These approaches have attempted to establish an interpretative framework for technology beyond the objectivism of processual and the subjectivism of post-processual traditions. The essence of their position lies in the claim that *meaning* and *function* constitute inseparable folds of the complex and dynamic nature of technology (Gosselain 1998: 78; Hegmon 1998). Thus, any study of technology must never dissociate the *social* or the *symbolic* from the *material* (Dobres 2000: 98). The isolation of *technology* and *style* leads only to the *de-contextualisation* and *de-historisation* of the technological practice and its objects (Pfaffenberger 1992: 504). Both meaning and functionality, symbolism and technicity, are emerging qualities that are shaped concurrently within the socio-culturally embedded technical practice. Indeed, they stem from the same material process. As Pfaffenberger stresses: "the symbolism so commonly inscribed in artifacts is not so much the *cause* of cultural meanings as is so often supposed", but symbolism is rather "the *consequence* of the *simultaneous* production of artifacts and meanings in patterned technological activity", which can be said to "embody a social template" (Pfaffenberger 1999: 160–161).

The background of such approaches can be found in a series of theoretical positions and respective debates already underway in the 1970s that challenged the earlier analytic dichotomies through which technology was construed. According to Lechtman, who in 1977 proposed the concept of *technological style*, a radical distinction between technology and style is neither possible nor conceivable; style is present at any moment of the manufacture process and is involved in every single technical choice (Lechtman 1977; cf. Lechtman 1993). In a similar way, Sackett argued that style cannot be understood as being "*adjunct* to the utilitarian functional form" of artefacts, but as a "latent quality", which is embedded in the objects during the *process* of their construction (Sackett 1986a: 268; cf. Lemonnier 1993a: 4; Schlanger 1994: 144; Wallaert-Pêtre 2001: 471). At any phase of the manufacture process, there are "equally viable alternative ways of achieving the same end, of meeting the same need" (Sackett 1986a: 268). Sackett described these as *isochrestic variations* (see also Sackett 1990). More than simply being technical, *technological choices* are neither always nor necessarily conscious, and they encode significant social and cultural identities and personal preferences (Sackett 1986a, 1986b; cf. also McGovern 1989; cf. contra Wiessner 1985). This *latent* or *passive style* of isochrestic choices that is non-intentionally produced while people are "doing things "the way they should be done"" (Sackett 1986a: 270), is mediated by the apprenticeship processes and the concrete enacting of a technique, i.e., by a *practice* (*sensu* Bourdieu) (Bourdieu 2013 [1972]), thus leading to the building of a *disposition* or *habitus* (Dietler and Herbich 1998).

Notwithstanding individual differences, the current theoretical debates in the French and American literature share the view that technology is a profoundly socio-cultural event, and they both urge for unifying conceptions of it. Their shared programmatic aim lies in the development of a theoretical understanding that would effectively overcome the neo-positivistic, analytic dualism between society and nature, meaning and technicity. The whole intellectual procedure is characterised by a crucial re-orientation of the theoretical interest from *objects* — and their conception through a dichotomic ontology of substances and attributes or of inert matter and active form — towards the socio-culturally charged material *processes* that constitute them. This turn of interest in the direction of the production processes contributes to a *de-reification* of material culture. The distinction between *things* and *techniques* or between *objects* and *processes* proves to be a crucial one insofar as it reveals that meaning does not adhere to the "fetishised objects", nor is it "added" to them by subjective interventions. On the contrary, meaning emerges within the socially charged *processes* of their production (Dietler and Herbich 1998). The processes of production and use of material culture is nothing more than a concrete way of unfolding the dialectic between its several aspects —

aspects which, if they are considered in themselves, i.e. *abstractly*, are nothing but a series of contradictory and hence sublated moments. Just as "society" for Pfaffenberger was nothing more than an abstraction from the socio-technical system, *technology*, *function* or *style* do not represent anything but abstractions from the *concrete syntheton*, from the *concrete totality* that material culture *is* and *becomes*.

These trends of modern French and American anthropology propose (implicitly or explicitly) a new and more dialectical way of understanding material culture, by shifting the axis from *analysis* and *abstraction* to *synthesis* and *concretion*; from *objects* to *processes*; from *reification* and *fetishisation* to *material social practice*. Nevertheless, one could retort that in many cases this alleged dialectics still echos Kantian rather than a genuine dialectics as shaped by Hegelian and Marxist traditions. To perceive function, meaning, the material (or natural), and the social as *co*-existent (or *non*-separated), and to insist on the synthesis of *technical rationality* with *non-technical logic* in the technological praxis (cf. Cresswell 1996; Lemonnier 1980, 1992, 1993a; Roux 2010), does not entail to conceive them as *mutually constituted*. Conceiving the constituents of technology as inseparably co-existing could be regarded as a kind of Kantian *synthetism.* But it does not fully transcend the *dualism* that is often presupposed rather than overcome (cf. Latour 2014: 507). Finally, such an abstract "co-existence" remains close enough even to those radical behavioural conceptions that treat technological practice as an external negotiation between nature and culture, and its outcome as a "compromise" between different variables (Skibo and Schiffer 2001: 143, 2008: 15–16).

To go beyond Kantian synthetism towards a genuine dialectic that would efficiently overcome dualism requires one to consider technology as a form of active, practical *totality*. This would encompass the material and the social not simply *synthetically*, but also in the form of a *negative unity*. This means to consider them as *mutually constituted* entities, where each receives its meaning, role, and function *in the practice* through active opposition and negative relation to the other. If function, materiality, or technicity are conceivable *only* through their opposition to symbolism, ideology, or style (and *vice versa*), that means that they are *real* abstractions from the *actual* totality of their existence. Their *reality* exists only along with their *actuality*, i.e., with their actual unity in practice, in the material social processes of production and reproduction of material culture. What subject and object *really* are (i.e., when they are viewed as detached, abstracted substances) is only what they *actually* become in practice. The outcome of the technological practice is thus not an amalgam of variables, but the dynamic result of the negotiation and clash of material and social parameters. The tension, the negativity and, hence, the possibility of technological change have been incorporated from the beginning.

Appendix to I.2: The *chaîne opératoire* approach: some theoretical remarks

The contemporary study of technology in the fields of archaeology and anthropology has taken special advantage of one of the most interesting and dynamic concepts of the French anthropological tradition: the concept of the *chaîne opératoire* (*operational chain* or *operational sequence*) (Pigeot 2011; Schlanger 2005: 18). The concept derives from the tradition of A. Leroi-Gourhan (1993 [1964]), and is considered to have its most distant theoretical roots in the anthropological thought of M. Mauss and his concept of organic enchainment (*enchaînment organique*) (Audouze 2002: 286–287; Dobres 2000: 125; Martinón-Torres 2002: 30; Schlanger 2005). It was not until the 1980s that the concept of the chaîne opératoire was established in the anthropological and archaeological studies of technology through the work of P. Lemonnier (Sellet 1993: 106). It has been argued, albeit in a superficial manner that ignores the dynamics of a given concept within its uses, that the term "chaîne opératoire" has an "ambiguous and debatable nature" (Martinón-Torres 2002: 30). Nevertheless, its application has proved its fertility for the study of technology in a number of different archaeological and ethnographic contexts. The concept of the chaîne opératoire has been integrated into a range of different theoretical perspectives, and is widely recognised (especially by contemporary social and cultural theories of technology) as a methodological scaffold that allows for a unified, holistic understanding of technology as an equally material and socio-cultural event.

Even so, the chaîne opératoire is not a theoretical tool *per se*, insofar as its concept does not necessarily entail any concrete theoretical position regarding the *interpretation* of material culture production. As has often been claimed, chaîne opératoire is a mere *analytic tool* (Dobres 1999: 125; Gosselain 2011b: 246), which imposes nothing on the analysed objects and procedures but the self-evident assumption that the production of any artefact must traverse a series of phases (or stages) (Audouze 2002: 287; Schlanger 2005), from the procurement of the raw material to the manufacturing of the final product. From this general perspective, a chaîne opératoire can be defined as referring to "the range of processes by which naturally occurring raw materials are selected, shaped and transformed into usable cultural products" (Schlanger 2005: 18). As P. Lemonnier argued, the elements of the chaîne opératoire "have a temporal dimension: they succeed one another, take place simultaneously, or overlap"; for that reason, "although a chaîne opératoire has a beginning and an end, it is not necessarily linear" (Lemonnier 1976: 106). The determination of the manufacturing phases of an object means to try to recognise and reconstruct all those elements that are involved in its production (raw materials, tools,

gestures, knowledge, and symbolisms), as well as the unique manner in which they play specific roles through their concrete articulation and correlation to each other. The selection of the elements and their articulation is determined, each time, by the specific decisions or choices of the artisans (Sillar and Tite 2000).

Besides this traditionally "French" conception of the chaîne opératoire, several approaches in recent decades that have gained recognition among some archaeologists and anthropologists have emphasised the need for an even broader *biographical study* of the objects (e.g., Kopytoff 1986). According to this view, a chaîne opératoire should embrace not only the phases of production, but also those of the use and discard of material culture (Sellet 1993: 109; Sillar and Tite 2000: 16), or even their entire, non-ending "life-cycles", which extend to the present (i.e., their re-contextualisation as *archaeological objects*, studied in laboratories, published in books, and displayed in museums) (Shanks 1998). In a similar vein, the concept of the *behavioural chain* was independently developed in American archaeology at the beginning of the 1970s and placed emphasis on the need for a biographical understanding of material culture that moves continuously from its production to its discard (Schiffer 1975; Skibo and Schiffer 2001: 142; 2008: 9–10, 20–22; cf. Martinón-Torres 2002: 37; Sellet 1993: 106). Nevertheless, these approaches have never become dominant in the archaeological and anthropological studies of material culture and technology as concrete analytic methodologies (Sellet 1993: 107). Despite their call for a unifying study of material culture that would follow the entire course of its material and socio-cultural transformations and re-contextualisations, they deny the discrete role that archaeologists and anthropologists have ascribed to *technology* in recent decades. Moreover, putting together in the same interpretive narrative both the production and use of material culture entails their conception as ontologically and methodologically identical events, something that contradicts the theoretical perspective of many contemporary scholars who wish to understand the specific differences between the processes of production and those of the use or consumption of material culture. Within the framework of "biographical" or "life-cycle" approaches to material culture, technology seems to lose its relative autonomy among other social practices, and be treated as simply one form of "use" of things among many others.

As previously discussed, the conception of the chaîne opératoire often appears to be rather instrumentalistic and a-theoretical. The chaîne opératoire is accentuated as a mere analytic tool that does not impose a specific interpretation on analysed things and processes, but follows their own nature and articulation. Even so, the establishment and elaboration of the chaîne opératoire concept within the framework of a specific anthropological tradition, like the French school of cultural technology, has inextricably entangled it with a specific

understanding of technology as a *social phenomenon*. This theoretically charged concept of the chaîne opératoire integrates in its spectrum the sum of the material and immaterial factors that co-determine technology (skills, gestures, agents, raw materials, landscapes, tools, social relations, religious beliefs, and moral prescriptions) (Gosselain 2011b: 246). Thus, the chaîne opératoire incorporates not only the technically (or functionally) necessary elements for the production of a product, but also the cultural context into which the production process is embedded. Furthermore, the recognition of the immaterial elements as inherent components of the technical procedure has allowed many scholars to treat the chaîne opératoire as an important tool for decoding and reconstructing the *knowledge* and the *conceptual schemes* that were enabled in the technical practice (Schlanger 2005). A series of *cognitive* approaches have used the chaîne opératoire as a methodological tool for the investigation, on a cross-cultural level, of the shared cognitive structures of the subjects and the way in which these are inscribed in the objects and the processes of their manufacture (Schlanger 1994; van der Leeuw 1993, 1994; Wallaert-Pêtre 2001).

All this makes evident that the concept of the chaîne opératoire is indeed a rather loose functional scheme, whose limits are determined in accordance with the specific questions posed by different research programmes and within their broader theoretical perspectives. As a conceptual construction, i.e., as an *abstract schema*, a chaîne opératoire does not determine its *concrete content* by itself. The range of the chaîne opératoire, as well as the range of each "phase" of it, do not simply represent objective facts, instead they are co-determined by the theoretical and methodological decisions of the researchers with regard to the *level of abstraction* wherein a specific study wants to move. Therefore, if we study, for example, pottery, it is obvious that there is no chaîne opératoire for the ceramic production *in general*, not simply because different potting techniques enacted in different socio-cultural contexts are patterned in distinctive ways, but because our own decisions regarding the level of abstraction of our analysis transform the chaîne opératoire from an abstract theoretical construction into a methodologically concrete analytic tool. Within the concept of the chaîne opératoire co-exists an *objective dimension*, i.e., a claim that what is documented *is* an objective fact that has been taken under study, and a *subjective dimension*, i.e., a recognition that *we* make an epistemologically determined decision to analyse and describe in a specific way a certain part of the reality. As O. Gosselain argued: "The notion of 'chaîne opératoire' pertains both to the process of transforming a single (or several) material(s) into a finished product, and to the analytical tool used for documenting such a process" (Gosselain 2018: 3). These two dimensions, however, do not simply co-exist, but are mutually conditioned, and only their

balancing can yield an epistemic narrative that would be accepted as valid by a certain research community. In order to talk in a meaningful way about a *pottery chaîne*, we have to choose if our point of reference is a region, a community, a social group, a household, an individual potter, or even a specific, individual vessel. The point of reference, i.e., the level of abstraction, is immediately connected with the kind of information (observable traits) that we can register in the archaeological record. In turn, this is immediately connected with the research questions that have been posed. For example, the mere distinction between handmade, wheel-made, and wheel-thrown pottery can certainly approach questions regarding major differences on an inter-regional level of pottery production. Nevertheless, it might not be able to take into consideration questions concerning the intra-communal and household level of pottery manufacture and circulation, insofar as it would require configuring a more detailed *pottery chaîne* by documenting the individualised habits (or material traits of these habits) and subtle interventions during the manufacture process, which would be necessary for identifying household "workshops" or individual potters, but could be regarded as superfluous for discerning broad technological differences between large regions.

Besides these aspects, it should also be noted that the level of abstraction, although regarded as part of the researcher's subjective decisions, is also conditioned by the analytic methodologies that are available to a certain research community or individual researcher. This aspect is especially important for archaeology, which leans solely on material things and not on the actual processes of their production. In this case, the affordable non-macroscopic, laboratory methods can decisively condition the obtained results and the degree of abstraction in the reconstruction of the chaîne opératoire. As recent studies have shown, the investigation of pottery primary forming techniques with reference to the concrete level of household production and the possibility of approaching technology in its entire spectrum of pluralism and dynamics up to the level of individual potter, can hardly be achieved without modern high-tech applications such as, for example, X-ray micro-CT scanning (Kozatsas *et al.* 2018). The *number* and *range* of the *phases* and the concrete *operations* of a chaîne opératoire are determined by the analytic methodology that we apply for acquiring information (e.g., macroscopic or microscopic observation, X-ray radiography, and micro-CT scanning). Hence, the determination of the content of a chaîne opératoire is each time the result of subjective methodological decisions by the researcher and objectively available laboratory applications. The way in which such aspects are co-structured in a concrete research programme are at the centre of the epistemological questions of interdisciplinarity (cf. Ehrenreich 1995; Hodder 2015; Sillar and Tite 2000). The underestimation of the importance of taking into serious consideration

the level of abstraction can either lead to the reduction of the concrete to the abstract (e.g., by eliminating technological pluralism on the household level in order to underline more general characteristics), or the inability to recognise the common characteristics among different technological traditions, if the universal, common elements are ignored in favour of emphasising the equally abstract infinite diversity of the particular. The question is not simply theoretical but also a critical methodological issue concerning the kind of questions that each researcher has to pose with clarity from the beginning.

Following these remarks, I would like to further challenge the relatively neutral understanding of the chaîne opératoire as "primarily an analytic tool" (Dobres 1999: 125), which does not entail a "theoretical statement" *per se* (Sellet 1993: 107). Given the need for a theoretical framework for the chaîne opératoire, for this to be concretised and become capable of research application, there is one more question that still begs for an answer: can we really regard the chaîne opératoire as an a-theoretical, contentually void methodological scheme, a mere analytic tool? Or does the form itself turn to implicitly impose its logical analyticity on the material under study? I want to claim that the important functional concept of the chaîne opératoire must not be understood in an instrumentalistic way as a neutral *method*, namely, as a "tool" that can instrumentally reveal the *truth*. The question here is not simply if the concept of the chaîne opératoire is susceptible to different theoretical contextualisations and can function heuristically for a range of different archaeological and anthropological paradigms. To my mind, the most critical point lies in the following: that its own form, the *analyticity* of its structure, implies a Cartesian ideal that the *syntheton* of a technological process must be reduced to its *simple* analytical steps (or units) in order to be properly understood. This inherent analyticity of the concept of the chaîne opératoire is indeed an implicit, untheorised assumption, which determines it morphologically as a specific methodology or research. How is it then possible to keep the concept of the chaîne opératoire and, at the same time, avoid the mere analyticity as a methodological and, hence, interpretive consequence? Is it possible to make use of the concept of the chaîne opératoire and, at the same time, avoid understanding technology as an analytical *aggregate* of elements and operations? Is it possible to represent the *unity* of the technological process, as expressed in the concept of the chaîne opératoire, as *immanent* in the process itself? To my mind, what is needed is to re-theorise the concept of the chaîne opératoire by challenging and redefining a series of latent assumptions that are implied by its general form.

The idea of *analytic units* of the chaîne opératoire, specifically its *phases* and the discrete *operations* that it encompasses, is certainly not merely a neutral morphological characteristic, but manifests specific epistemological

consequences for the *content* itself. The discussion about the independence or not of each phase of the chaîne opératoire (see Gosselain 2000: 190; Sellet 1993: 107; Sillar and Tite 2000: 5) necessarily follows (i.e., it is an issue that *has to* be debated) from its very morphological analyticity. My point is that the need to anatomise the technological practice by discerning specific phases in the manufacture process does not necessarily entail a narrow analytic conception of it. As such, the critical point lies in the following two questions: 1. Are the phases of the chaîne opératoire analytically prior elements of the technological practice, or posited moments that are abstracted from the totality only for the sake of an analytic scientific approach? 2. What is the logical relationship between the different phases of the chaîne opératoire? I want to argue that both questions can be understood through a consideration of the relationship between *efficient* and *final causes* in the chaîne opératoire, namely, through the consideration of the relationship between the *deterministic* and the *teleological* dimensions of technological practice as a process developed in time.

On the one hand, a phase can be regarded as the realisation of a specific *end*. From this perspective, each phase can be regarded as a goal subjectively posited by the artisan, or, in other words, as the realisation of a subjective desire. Insofar as the phases of the chaîne opératoire are seen as subjectively posited, they can be regarded as independent from each other. For example, in the case of pottery manufacture, the collection of raw material and the preparation of the clay fabric can be regarded as decisions that were made *independently* from the decision to build a pot with coils or slabs, and further from the decision to smooth or burnish its surface, and to decorate it with painted or incised motifs. The chaîne opératoire, therefore, can be seen as a *series* of independent decisions that, when taken together, result in the form of the final product. On an elementary level, the logical independence of the different phases makes possible the social division of labour and the distribution of the chaîne opératoire among different members of a community. The possibility of the social division of labour is rooted in the *logical structure* of the technological process and can be met not only in the case of highly specialised production, which would also require the co-operation of highly skilled individuals, but also in the hand-making household production, where the pragmatic reasons for the division of technical activities can be driven directly by cultural customs (for example when *men* are considered *a priori* as destined to manufacture the pots and *women* to decorate them).

Nevertheless, the phases of the chaîne opératoire are not merely abstract realisations of autonomously posited ends, insofar as *each* single phase is subjected to the *same* process that is developed within a concrete space and time. As such, it is obvious that the earlier phases of the chaîne opératoire *causally* (co-)determine the following ones. What has been achieved at a

certain phase *conditions what can be done* in the following phases. Consider, for example, the operations of *preparation* of the construction units (e.g., rolling the coils or pressing the slabs) and those of *joining* the construction units following a set of specific technical gestures. The two operations can be well regarded as two distinct stages in the manufacture process, i.e., as the outcome of different ends, decisions, and respective actions. They are performed at different times and can be undertaken either by a single potter or by different members of the community (e.g., an apprentice can roll the coils or press the clay slabs that will be consequently assembled together by the master). The tempo of the preparation of the construction units, however, and the time-lapse between the preparation and the utilisation of each one (which immediately affects the humidity of the clay and its adherence) as well as their thickness and length, are decisive factors that condition what will be done in the following phases of the chaîne opératoire. Without adapting either the goals or the technical gestures for achieving these goals (e.g., superimposing the coils and joining them through subtle pinching, or crushing them during their placement), the results can be significantly different. For example, the construction units could fall apart during the drying phase due to deficient adherence caused by inadequate humidity which, in turn, is immediately connected to the tempo of their preparation and the temporal relationship between the phase of preparation of the construction units and the phase of their joining. Another example could be that thick coils, which have been superimposed and not crushed-and-drawn, might require intensive cutting and scraping of the pot's surface if the potter wishes to achieve relatively thin vessel walls. Whereas the teleological independence of the different phases of the chaîne opératoire enables its *analytical distribution* and grounds the possibility for a division of labour, the materiality of the chaîne opératoire's components enforces the internal harmonisation of its phases and the collective collaboration in the production of the objects. The technological process, as illustrated through the concept of the chaîne opératoire, is shown to be a two-dimensional procedure: on the one hand, it is characterised by the *teleological independence* of the different phases and, on the other hand, it is discerned by a strong *causal dependence* developed between them.

The question, therefore, is how both *independence* and *dependence* of the phases are actually related to each other and unified in the technical process, how *teleological positing* and *causal determinism* are united. The answer can be found only if we go beyond the analyticity of the distinct phases of the chaîne opératoire. Giving prominence to the distinctiveness of the phases leads necessarily to an oscillation between ends and causes, between intentionally posited goals and causally conditioned results. What is overseen from such an analytic point of view is that we cannot merely assert that the technical choices

made within a certain phase are really independent from the ones made during a following one, or that the latter are merely causally dependent on the former, because the wish to achieve a specific goal at a specific phase co-determines (as a *final cause*) the technical choices to be made during the earlier phases. Let us consider one more example from pottery manufacture. It is a mere analytic truth that in order to achieve a homogenuous burnishing of a pot's surface, the roughout must have been already built up and its surface carefully smoothed. From a teleological perspective, burnishing can be regarded as functionally autonomous from the phase of the primary construction of the roughout and the rest of the secondary operations (cutting, scraping, smoothing). Nevertheless, the quality of burnishing, the time invested in it, and the techniques employed, depend on the choices made in the earlier phases of the manufacture process, and are essentially conditioned by them. Furthermore, burnishing is directly conditioned by the natural characteristics of the clay (e.g., how calcareous or siliceous the raw material is), the inclusions added (quantity, size, and shape), the possible application of extra slips, the quality of smoothing, the humidity of the clay, and even vessel's own shape. At the same time, the desired quality of the burnishing determines the decisions made in the previous phases of the manufacture process: the desire to give specific characteristics to a final surface co-determines *retrospectively* the technical choices made in the earlier phases.

Thus, the technical choices met in each phase of a chaîne opératoire are neither independent nor dependent. On the contrary, it is the thorough *inter-reference* of different choices and the interplay between *causal* and *teleological* determinations that unifies the technical process. This unity becomes manifest not only in the form of the final product but also in the practical experience of the technical process itself. As such, the chaîne opératoire can be recognised as a dividual descriptive sequence whose dividuality is inherently conditioned by its unity which, in turn, is grounded in the dialectical relationship between its causal and teleological dimensions. Its analyticity, in the form of discrete phases, allows the distinct investigation of a part of the manufacture procedure, such as (in the case of pottery) the primary formation of the roughout, the treatment of surfaces, or the firing of the vessel. Nevertheless, the degree of dependence or independence of each phase of the chaîne opératoire does not simply lean on functional or material determinations, but is inherently connected with socio-culturally determined patterns of behaviour that penetrate the technical act and co-determine the goals and the decisions.

The explanation of this complex procedure can thus be neither *deterministic* nor *teleological*: the production of an object is *holistic*, which means that the modification of any technical variable during its construction always takes into consideration the *totality* of the other variables in the technical process. Even when a specific choice at a specific phase of the manufacture process does

not seem to affect the choices to be made in the other phases, this is not an indication of autonomy, but presupposes that the artisan, who meets a decision, has the *entire technical process*, the entire production sequence of the object in view. The apparent neutrality or autonomy of a single phase presupposes the *actual recognition* of this very neutrality or autonomy of it against the *total work-plan* of the artisan. The whole procedure presupposes the *continuous* negotiation of the causal and teleological dimensions of the technical practice. The technological process as articulated in the form of a chaîne opératoire is possible only as a total plan which, far from being the expression of an abstract subjective will, is a reflectively unifying procedure: a teleological positing that does not simply *posit*, but a teleological positing which, each time that it posits, recapitulates the totality of the technical process as a dialectic inter-determination of efficient and final causes. An analytic detachment of the operational *units* disregards the fact that for the artisan himself, the different phases co-exist in a *total plan* that expresses a traditionally established practice, and integrates in a patterned way the desired result along with the materiality of the raw materials, the environmental conditions, the individual skills, the habitual gestures, the affordances of the tools, the individual and social needs, the social relations, and the cultural values of the place and time. Thereby, the autonomy or not of any given phase of the chaîne opératoire is, *as such*, a specific research question, i.e., something that must be investigated and interpreted *in concreto*, something that must be concluded and not presupposed.

The long ethnographic research of Olivier Gosselain in hundreds of communities across Sub-Saharan Africa represents one of the most exemplary investigations of the way in which natural resources, functional determinations, and socio-cultural variables are interrelated, patterned and finally merged in the production of pottery, and how different variables are co-patterned in a structured sequence, i.e., in a chaîne opératoire. For Gosselain, *ceramic traditions* represent specific *sociotechnical aggregates* (Gosselain 2000: 190; cf. Gosselain 2018), which treat and structure, at the same time and within the same technical process, material objects and social relations, *technological identities* and *social identities* (Gosselain 2000: 189). Moreover, each phase of the chaîne opératoire can be connected with a discrete assemblage of social identities and relations (Gosselain 2000: 189), so that the steps crossed could be seen as a symbolic discourse or a "dialogue between nature, culture and the material world" (Gosselain 1999: 206). An outcome of this specific structuration is also the relative autonomy of the different phases of the chaîne opératoire, which Gosselain detects. The visibility of the technical traits of the different manufacture phases on the final product itself (from the clay procurement, the preparation of the ceramic fabric, and the shaping of the vessel's roughout till the final treatment of its surfaces, its drying, and firing); the significance (or not) of the visibility of these traits for the potters

and the consumers of the pottery, which can be denoted by their accentuation or elimination (e.g., traces left behind by a potter's wheel on a pot's surface), are determined by the networks in which the final products participate, the specific social spaces in which each phase of the chaîne opératoire is realised, and the skills required for the realisation of a specific manufacture phase, as well as a number of other "technical" and "cultural" factors (from the quality of the natural sources to the symbolic prescripts and prohibitions). All of these elements are inscribed in the chaîne opératoire and determine its character and the durability of pottery manufacture techniques through time (Gosselain 2000; 2012). In a sense, each phase can be regarded as a discrete *technological tradition*, shaped through a discrete historical course and with a discrete dissemination in space and time. Each phase participates in the *dialogue* of the overall chaîne opératoire and debates its material determinations and the meanings inscribed in it. For example, Gosselain's ethnographic research has persuasively shown that those pottery *primary forming techniques* that require high skills and have a very low *visibility* on the final products establish the most stable technological traditions which alter extremely slowly over time. Their *invisibility* excludes them from a significant part of the social networks, in which the pottery circulates, insofar as they cannot be observed and hence easily copied and transformed. They are reproduced only on a participatory basis and within specific communities of practice and practical apprenticeship. On the other hand, the possibility of an "isochrestic" variation of the techniques plays a crucial role in the stabilisation of a technique in time, insofar as the morphostylistic renovation of pottery (i.e., the creation of new shapes and wares) is often possible without changing the established primary forming techniques (Gosselain 2000; cf. Carr 1990: 17).

To my mind, these remarks and the above presented theoretical reflections show that the chaîne opératoire approach can be fertile for contemporary research and its questions in the framework of an *holistic conception* of technology and material culture (cf. Dietler and Herbich 1998: 245), which would leave adequate theoretical space for the deployment of cultural particularities, distinctive technological identities and technological differentiations, and for considering the materiality of the technical practice together with the social dynamics of technology and technological change, of apprenticeship, and of standardisation (cf. Dobres and Hoffman 1994: 137). Chaînes opératoires are structured and restructured, spread in space and transmitted from generation to generation, maintained or transformed within specific *communities of practice* (*sensu* Wenger 1998). They shape discrete technological traditions and are reframed and transformed through their dynamic interaction and participation in the production and reproduction of social and cultural identities. Technology is not simply a social activity but an emblematic social phenomenon that recapitulates the totality of the material and intellectual existence of a society in space and time.

I.3 Symmetrical theory and the phenomenology of material culture

The transition to the twenty-first century is characterised by the gradual breakdown of post-modern thought in all branches of the humanities and social sciences. Phenomenological approaches to society, material culture, knowledge, science, and technology have become even more popular in philosophy and social theory, often under the label of "new materialism(s)", whereas they urge for the need to overcome modern dualism and reconsider the agency of matter and the role of corporeality together with the social construction of the world from a "posthumanistic", phenomenological perspective (Coole and Frost 2010; Dolphjin and van der Tuin 2012; Parikka 2013). In the fields of theoretical archaeology and anthropology, these trends have recently formed new theoretical lines of thought, strongly influenced by Heideggerian phenomenology, post-phenomenology, American pragmatism (e.g., the semiotic theory of C.S. Peirce), and social constructivist approaches (Knappett 2005; Latour 1991, 1993, 2005; Olsen 2003; Shanks 2007; Webmoor 2007; Witmore 2007). The most distinct among these new trends is usually self-defined as "symmetrical theory" (Olsen 2003, 2012; Olsen and Witmore 2015; Shanks 2007; Webmoor 2013; Witmore 2007, 2014). Symmetrical approaches have proposed a new form of empiricism (cf. Witmore 2014, 2015), which seeks to replace the objectivistic or subjectivistic empiricism of older epistemology — most apparent in processual and post-processual theories — with the neo-romantic idea of an *immediate*, *pre-conceptual* experience of an individual thoroughly immersed in the world of the "Being" and powerless to distinguish itself (*practically* and *thoughtfully*) from the other, or to grasp the essence of things (cf. Thomas 1996).

Due to this phenomenological concern with *things* and the *material* aspects of the world, a greater interest in technology has been associated with a turn to and a re-conception of the *materiality* of material culture (Boivin 2008; Cornell and Fahlander 2007; DeMarrais Gosden and Renfrew 2004; Fahlander 2012; Hodder 2012; Ingold 2013; Knappett 2005; Meskell 2005a; Miller 2005b; Olsen 2010; Tilley 2004) – essentially, of a materiality "without materialism", as the philosopher G. Harman emphatically underlined (Harman, 2011: 40). Contrary to the older accusation from post-processualists that the material culture of New Archaeology was "dehumanized" (Shanks and Tilley 1987b: 77), phenomenological approaches have instead targeted the dominating "anthropocentrism" of material culture studies (Knappett and Malafouris 2008: IX) and "the long dictatorship of human beings" over the non-human world (Harman 2002: 2). They claim the need for "de-centering humans" (Webmoor 2007: 570) in order to establish a theoretical "democracy extended to things" (Olsen 2003; Olsen and Witmore 2015; cf. Bryant *et al.* 2011; Latour 1993: 12;

Shanks 1998: 28), and hence for the complete abolition of any ontological and categorical differentiation between *subjects* and *objects*, i.e., for a "symmetrical levelling of humans and things" (Webmoor 2007: 565). By rejecting the dualistic empiricism of the past, these phenomenological trends have postulated an even more radical empiricism of the "practical, non-discursive experience" (Olsen 2010: 78), i.e., an empiricism in the form of the abstract neo-romantic holism of an immediate experience's practical "circumspection" (*sensu* Heidegger), or of the non-conceptual, non-verbal, tacit knowledge of immediate perception (*sensu* Merleau-Ponty) (cf. Heidegger 2000a [1950], 2000b [1953], 2006 [1927]; Merleau-Ponty 2002 [1945], 2004 [1948]; for an overview see Dreyfus 1991). Instead of investigating the concrete relations between humans and the material world ("natural" and anthropogenic), this knowledge-eliminating position counter-poses a fluid, non-definable, "ghostly cosmos in which humans, dogs, oak trees, and tobacco are on precisely the same footing as glass bottles, pitchforks, windmills, comets, ice cubes, magnets, and atoms" (Harman 2002: 2).

The question of technology and the problems of a contemporary anthropology of technology have strongly concerned this new trend (e.g., Ingold 2000, 2011, 2013; Latour 1993, 2005). Apart from direct references to the twentieth century phenomenological tradition, symmetrical theory and other phenomenological approaches have been substantially affected by the developments in the history and philosophy of science and technology in the English-speaking world, especially from the 1980s onwards. Within the theoretical framework of the epistemology of D. Bloor and the Edinburgh School (Bloor 1991), a whole new field has emerged that deals with questions of technology, known under the synoptic title of Science and Technology Studies (STS). Apart from a distinct emphasis on the social construction of technological systems (Bijker 1993; Bijker *et al*. 1987; Brey 1997; Winner 1993), STS studies have interpreted technology not as the formation of a concrete human-nature relationship, but as the development of several ontologically uniform variables within a limitless network of hetero-relations, better known as the Actor-Network Theory (Hughes 1986; Latour 1996, 1999, 2005; Law 1991). Actor-Network Theory has been integrated into modern archaeological and anthropological theory (cf. Hodder and Mol 2015; Ingold 2011; Knappett 2012, 2013), while phenomenology and social constructivism are now at the epicentre of contemporary debates on the anthropology of technology (Yalouri 2012; Ingold 2000, 2011, 2013; Julien and Rosselin 2009; Knappett 2004, 2005, 2014; Knappett and Malafouris 2008; Latour and Lemonnier 1994).

Despite the evolving dynamics of symmetrical theory in the even more fluid post-post-modern intellectual milieu of the twenty-first century, the

fertility of these approaches for the study of technology remains questionable. The postulated — and only postulated — ontological uniformism is seriously at risk of becoming a paralysing condition that cancels out any difference between the subject and the object, and hence any relation and dynamics. The introduction of the concepts of "distributed cognition" and "distributed agency" (Malafouris 2004, 2008), although often connoted with a discourse about the "interaction" between people and the material world or even their dialectic relationship (e.g., Malafouris 2004, 2013), does not always avoid the reduction of practical activity into a non-determinable fluidity of hetero-relations between ontologically uniform elements. It is difficult, therefore, to reconstruct technological process and to follow the structured ways of the interweaving of its actual constituents, such as raw materials, tools, habits, and social meanings. Subjects, objects, and tools seem, in the end, to be dissolved, as discrete elements of the technical act, in a non-tangible continuum of the activity itself (see Malafouris [2008] on the "potter's wheel"). By ignoring the structural differentiation between subject and object, phenomenology not only violates (instead of interprets) the phenomenal level of practical relation, but leads to the cancellation of any discourse of technology. The relation of several ontologically indifferent elements, like nodes in a limitless network, negates technology as a discrete sphere of material social practice. Technology, as a distinctive process that reveals the constitutive interweaving of socio-cultural relations and meanings with matter, escapes from the phenomenological understanding of it. On a practical level, the subject-object relation is severely short-circuited as any ontological distinctiveness of the elements is principally disputed. Subjects and objects are not only rejected as metaphysically pre-given substances, but also as elements gaining their ontological integrity through the development of the practical process itself. On a theoretical level, the endeavour results in a radical agnosticism, insofar as both subjects and objects are annihilated in the undifferentiated continuum of experiencing the "Being". There is no point where we could arguably distinguish a human being from an objective being of the world; there is no way to draw a line cognitively or reflectively between the entities, insofar as "our own being cannot be separated from that of the world we inhabit" (Olsen 2003: 97–98).

As Hodder stressed, "'symmetrical archaeology' risks throwing out all the dynamism of human-thing relationships along with the bathwater of human-thing binarism", whereas it is exactly the "dialectic" of this relation — a "unity of the opposites" — that "generates change" (Hodder 2014: 228). Emphasising the "entanglement" (Hodder 2012, 2016; Ingold 2000, 2013) between the subject and the object, between the artisan and the material, does not necessarily entail their dissolution in an undifferentiated continuum. On the contrary, the human-thing entanglement reveals their actual interrelation

and interdependency; or, to put it in a more dialectical manner, their inter-constitution and, hence, their antithetical unity within practice. Contrary to this dogmatic ontological levellism of phenomenology, what is needed is the recognition that the *relation* is characterised by ontological primacy against any metaphysically isolated subject and object, while out of it comes nothing but inert objects, in the same way that a tool becomes an "inert object" when it is "divorced from the context of production" (Ingold 2000: 319). Privileging the relation over its constituents does not necessarily entail the annihilation of the elements (of the constituents) in a non-graspable phenomenological field of the "Being". On the contrary, it entails the recognition of their deep structural relation, their dialectical nature, and the concrete way in which they are ontologically constituted through material social practice. As I will try to argue in the following chapters, dialectical tradition seems sufficiently capable of forming an alternative answer, and more capable of reconciling the *practical opposition* of subject and object with a *monistic conception* of both in and through the practical activity itself. From a dialectical point of view, technological practice, instead of being an annihilating process wherein subject and object are equally cancelled and "distributed", it is understood as a process of the *actualisation* of human and nature as *opposites*, and, at the same time, a process of *unification*: of identical-making of both through their active interdependence. For dialectics, it is only through and within practice that human agents, material nature, and tool-mediators are posited, concretised, and actualised as ontologically discrete constituents, relationally developed, and negatively united, i.e., united due to their active opposition to each other.

PART II

Hegel and the Concept of Practice: Elements for a dialectical theory of technology

II.1 Dialectics in contemporary archaeological and anthropological theory

Hegelian dialectics continues to be one of the most ignored theoretical traditions in archaeology and anthropology. Apart from the works of D. Miller (1987, 2005b) and W.H. Marquardt (1992), few scholars have ever seriously engaged with the classical dialectical tradition and tried to test its potential for contemporary theoretical debates. One might assume that the difficulty of Hegelian philosophy discouraged scholars to deal with its idiosyncratic language and transcribe it into the language of archaeology and anthropology. Nevertheless, I believe that such an argument is unconvincing. From the time of V.G. Childe until today, there have been many theoretical archaeologists and anthropologists who have not hesitated to read and make use of a vast number of philosophical texts, including the works of Ch.S. Peirce, A.N. Whitehead, M. Heidegger, M. Merleau-Ponty, L. Wittgenstein, C.G. Hempel, C. Popper, Th. Kuhn, R. Rorty, Th. Adorno, H. Marcuse, J. Derrida, G. Deleuze, many of which are readily identified by contemporary scholars in philosophy as some of the most difficult (even cryptic) texts in the history of philosophy. Instead, the absence of any engagement with the Hegelian dialectics should be attributed to a more general intellectual disposition, or even quasi-ideological bias against late modern German philosophy, especially against Hegelian dialectics. This negative connotation of the dialectical tradition is immediately connected with the domination of neo-positivism for much of the twentieth century, and the refutation of Hegelian philosophy as the most characteristic paradigm of "nonsensical" metaphysical thought that the "new scientific spirit" had to tirelessly fight (for a discussion on the anti-Hegelian roots of neo-positivism, see Redding 2014: 1–20; Welsch 2005). However, a more thorough investigation of the reasons that led to this and the way in which archaeology and the Humanities in general have been affected is beyond the scope of this book.

On the other hand, despite the long-held ignorance of the dialectical tradition, "dialectic" has appeared, in recent decades, as a tempting theoretical term for several currents of theoretical thought in archaeology and

anthropology. Contrary to earlier decades, when dialectic had been entirely "neglected by processual archaeologists" (Marquardt 1992: 102–103), both as a research methodology and as a structural form of material culture and human society, it is remarkable that contemporary theoretical trends, due to their strong anti-dualistic orientation and their attempt to consider both material and social agency, i.e., both the object and the subject, as active co-determinants of the socio-cultural "Being", are much more amenable than before to make (at least verbally) use of the dialectic. Although Hegelian thought *per se* has never been debated seriously, there is abundant use of the term "dialectic" in a significant number of theoretical texts in archaeology and anthropology. Expressions like "the dialectic of people and things" (Meskell 2005b: 4; Preucel and Meskell 2004: 16), "the dialectic between past and present, object and subject" (Hodder 1991a: 9), the "ongoing dialectic between people and things" (Ihde and Malafouris 2019: 196), or statements like "action [...] is in dialectical relation to structure and social context" (Shanks and Tilley 1987b: 72), "the relationship between material culture and people is complicated, context-specific and dialectical" (Dobres and Robb 2005: 161), or "human-thing relations are dialectical in that the unity of the opposites generates change" (Hodder 2014: 228), are quite often found in the contemporary archaeological and anthropological literature. The question, however, is what is really meant by this term. It is more than obvious that, in most cases, when the term dialectic comes into play, it is used in a rather commonsensical way, which distorts its meaning and turns it into a doctrine of mere *interaction* between different variables in material culture and human practice. Implicitly or explicitly, the terms "interactive" and "dialectic" are quite often construed as mere synonyms and consequently used interchangeably (see e.g., Hodder 1990: 154; Dobres and Robb 2000: 4).

Nevertheless, reducing dialectical relations into a set of mere interdependencies can heavily subvert the critical anti-dualistic dimension of dialectics. Mere abstract interdependence emphasises a relation between entities that ontologically *pre-exist*, although they are supposed to be conceived only in their relation to each other. Such a concept is quite close to what has been previously called *synthetic dualism*, according to which the opposing elements (like technician and matter, style and function, individual and society) are treated synthetically, i.e., only within their relation and not abstracted from it. Such a *synthetic* conception means, however, that the elements are *not* necessarily *posited* by the relation as such, and they do not gain their ontological integrity through *mutual active relating*, but their ontological integrity *precedes* the relation. On the other hand, this commonsensical understanding of dialectics, which reduces it to a doctrine of interdependence, has often interpreted it as compatible with modern relativistic positions like

hermeneutics. Even when Shanks and Tilley (1987a: 110ff.), in their early works, appealed to move "beyond hermeneutics, towards dialectics", the result was a similar simplified concept of dialectic that was easily equated with a kind of "hermeneutic circle", wherein no truth and no distinctiveness is ever possible due to the relativity and hetero-relationality of the elements. Following Shanks and Tilley, Hodder also transcribed the term "dialectic" in some of his early writings as an *explanans* of the meaning of the hermeneutic circle (Hodder 1991a: 10–11; cf. Marquardt 1992: 103).

Besides the above examples of post-processual archaeologists, the term "dialectic" has also been cited by archaeologists and anthropologists who are otherwise orientated towards different (post)phenomenological and interpretive approaches. Nevertheless, the textual ignorance of dialectics has often led to a theoretical confusion, an apparent misrepresentation of dialectical thought, and a rather sterile polemic against it. For example, in a recent paper, T. Webmoor and C.L. Witmore undertake the ambitious task of getting rid of the "impoverished logic of dialectics", its "mystical process" of the "mutual constitution" of people and things and of "objectification", and its "myth of the eternal return" (sic) (Webmoor and Witmore 2008: 56–57). The question, however, remains the same: what do the authors mean with the term "dialectics" and whereupon do they base their own understanding of it? To the second question, the answer is that there is no textual reference to any dialectical philosopher.[3] In order to answer the first question, it is better to quote the authors themselves:

> To characterize such relations [between people and things] as *dialectic* in nature is to *begin* with a particular, asymmetrical bifurcation of the world. Things and human beings are regarded as ontologically distinct, as detached and separated entities, a priori. Of course, within dialectics it is possible, many claim, to escape dualism through a fusion, a synthesis of the two extremes. Indeed, with this third position, a dialectical scheme allows for hybrids, but it is very much a hybrid, a composite, of two refined and unadulterated components in equal proportion [...]. Dialectics begins with the bifurcation and separation of entities such as people and things or agencies and structures or pasts and present and then moves toward the resolution of that dichotomy. (Webmoor and Witmore 2008: 56)

This excerpt illustrates the critical misrepresentation and misuse of dialectics by some contemporary theoreticians. To claim that the dialectical tradition "begins with the bifurcation" and with entities that are regarded, "a priori",

[3] It is peculiar that the authors cite a number of philosophers like B. Latour, M. Serres, I. Hacking, A.N. Whitehead, L. Wittgenstein, G. Deleuze, R. Rorty and G. Harman, yet make no effort to draw on the works of Hegel (or even of other dialecticians) despite targeting dialectics in their text.

as "ontologically distinct", i.e., as "detached and separated", while any "resolution" of the "dichotomy" comes only *afterwards* and in the form of a "fusion", a "synthesis" or a "composite", means to ignore Hegel's polemic (from his earliest philosophical writings to his latest major works) precisely against such views, i.e., against any abstract separation from subject and object as primordial ontological substances.

In a similar way, L. Malafouris equates Hegelian dialectics with the same dualistic view. Believing dialectics to be a dualistic theory, which holds that *ontologically pre-existent* subjects and objects merely interact with each other, he notes that his own "dialectical approach to the study of material culture" and the investigation of the dialectic of people and things (or of "minds and things") has some "important differences" from traditional dialectics, insofar as he does not consider subject and object as "isolated and independent elements" (sic) (Malafouris 2013: 9). To the contrary, as he further argues, his own (allegedly non-traditionally-dialectical) claim admits that "minds and things are continuous and inter-definable processes" and that "by knowing what things are, and how they were made what they are, you gain an understanding about what minds are and how they become what they are – and vice versa" (Malafouris 2013: 9). Nonetheless, this extremely important formulation of Malafouris does *indeed* re-posit the ontology of human, nature, and material culture on a genuine dialectical basis, and can be traced back to the entire dialectical tradition of the nineteenth and twentieth centuries — from Hegel's *Phenomenology of spirit*, and Marx's and Engel's *German ideology* to the works of J. Hyppolite, A. Kojève, G. Lukács, J. Habermas, K. Kosík, L. Vygotsky, and others.

It becomes evident that, in many cases in contemporary archaeological and anthropological theory, the dialectic approach is contentually included even if it is verbally rejected. The alleged critique of dialectics is often just a critique of a falsified picture that does not have any resemblance to what has been developed under this rubric over the last two centuries. As an outcome, statements like the "ongoing dialectic of our creating things which in turn create us" (Malafouris 2013: 44) or "cognition and action arise together, dialectically forming each other" (Malafouris 2013: 74) are mistakenly seen as compatible with positions of zealous disputants of the Hegelian dialectics, like B. Latour, or with J. Law's social constructivist approach (Malafouris 2013: 44–45). The dialectical approach nevertheless emphasises the "mutual constitution" (and not simply the mutual "interaction") of subject and object within practice (cf. Meskell 2004: 3, 4; Miller 2005b: 9), and can hardly become compatible, in any way, either with Latour's metaphysical "mixtures" and "hybrids" (Latour 1993) or with the socially constructed technological objects of advocates of STS. As will be shown in this chapter, dialectics — as a radically anti-dualistic

position — argues precisely for the *primacy of the relation* throughout the ontological field. For dialectics, the elements of a relation are not presupposed, but are *posited* by the relation itself, i.e., through the development of a *practical activity*. The "unity of the opposites", which Hodder accentuates, does not simply imply a positive mixing or con-joining of them, but their immanent *negative unity*, their unification not *despite* their antithesis, but *due to* their antithesis, due to their mutual opposition. Moreover, this very opposition develops within the activity itself and is posited by the activity — subject and object emerge through the activity as concrete substances and have no ontological integrity before their practical development.

Notwithstanding theoretical inaccuracies and the general lack of textual references to one of the most influential traditions of late modernity, it is more than striking that contemporary debates have turned towards a more dynamic, inclusive and, ultimately, dialectical conception of material culture both in archaeology and anthropology. The importance of this fact must be neither overseen nor underestimated. Nevertheless, before any concrete dialogue between dialectics and other theoretical approaches becomes possible, it is important to see what the dialectic approach is about, how it conceives and restates the question of subjectivity and objectivity, how it understands the role of practice in the development of the socio-material world and, finally, if it indeed offers an alternative theoretical framework for understanding the technology of material culture. To date, the lack of any direct textual involvement with the dialectical tradition has denied archaeology and anthropology the possibility of engaging in any real theoretical debate with a significant intellectual tradition of late modernity; a pursuit that could open new horizons for debate and theoretical reflection, help to reframe research questions, and search for possible answers. Whether we want to accept or reject or reframe dialectics, we must nevertheless approach it in a textually concrete way.

II.2 The dialectic of practice: reconsidering Hegel

Dialectics offers one of the earliest and most comprehensive anatomies of practice. It represents one of the most significant theoretical attempts to understand the ontological and epistemological implications of practice, and trace its indispensable role in the configuration of "Being", knowledge, and human society. Despite this, Hegel's theory of practice still remains one of the most ignored theoretical traditions, not only in anthropological studies of technology but also in the field of philosophy of technology itself (Hubig 2001). With few exceptions (Hubig 2001; Huson 1998; Juchniewicz 2018), the Hegelian theory of practice has never been considered as a discourse with

a dynamic dimension for approaching questions of contemporary philosophy of technology, and even less of archaeology and anthropology of technology. Among the several elements of technical practice, which are explicitly thematised in Hegelian work (including the concepts of labour, work, tool, goal, and nature), philosophical discussion has primarily focused on the concept of *labour*, which has been considered mainly in its narrow economic dimension (Arndt 1985: 100–101; cf. Lakebrink 1963; Lim 1963). Two main reasons could be regarded as decisive for such a labour-centred interpretation of Hegel's theory of practice: first, the belief that the concept of practice, which is already met in the earliest Hegelian texts of the Jena period, derives directly from the political economy of the eighteenth century (Arndt 1985) and thus belongs to the sphere of political philosophy than that of ontology and epistemology; second, the "Marxist" reading of Hegel which has unilaterally emphasised the concept of labour against other elements of practice (Lukács 1975 [1948], 1978b, 1980) — although for Marx himself the question of the technological development of the means of production played a decisive role in the question of human's social development. In the frame of the Marxist readings of Hegel, the discussion has usually focused on the problem of "alienation" with reference either to the Marxian concept of "objectification" or of the Hegelian "externalisation" (Arthur 1986; Christ 2015; Seyers 2003; Wendling 2009).

The concept of *practice* (Tun, Handlung), which for Hegel represented a concept that included a broad socio-material technical universe that interweaves desires, intentions, techniques, skills, labour forces, tools, raw materials, and final products in a structured constitutive relationship, is still overlooked in the literature in favour of a metaphysics of labour. This labour-centred interpretation of the Hegelian theory of practice unavoidably leads to a subjectivist conception of the ontological significance of technical practice (focusing merely on the question of how the subject is constituted) by unilaterally emphasising the goal-positing activity of reason. Thus, the twofold ontological dimension of practice, i.e., practice as a kind of material "reflection" (Arndt 1985: 102), which posits *both* the subjectivity and the objectivity, is forced to the background. The underestimation of this twofold ontological dimension of practice and the emphasis on the question of how the abstract subjectivity is concretised through its "externalisation" or "objectification" is common among most of the classical readings of Hegel, from A. Kojève (1980 [1947]) and J. Hypollite (1974 [1946]) to G. Lukács (1978a, 1980) and M. Riedel (1976).

Hegel's works, most notably his seminal *Phenomenology of spirit*, offer a long argumentation on how a reconsideration of the concept of practice can restate questions of ontology and epistemology. Practice is seen as the lab

wherein the ontological field is constituted and knowledge is grounded. To anticipate the following discussion, we should note that Hegel's approach can be summed up in three basic theses. First, ontological dichotomy of subject and object, which was previously taken as given and primordial, can never become *actual* and, therefore, *concrete* until a human enters the world as an *active*, *practical* being. Before the development of practical activity, which results in the production of a particular *work* (of a product), it is not ontologically possible to divide the reality in subjects and objects. Second, practice is not only an ontogenetic process, but also an epistemologically significant event. Practice opens up the cognitive space of consciousness. Only what is ontologically constituted through practice can really be known either morphologically, as a subject and object in general, or contentually as a concrete thing of multiple determinations against a concrete individuality of multiple skills, and desires. Knowledge of the thing and self-knowledge are mutually conditioned and anchored in the practical activity itself. Third, contrary to the dualistic view, the practically posited opposition of subject and object underlines at the same time their inherent unity as opposites. For dialectics, the unity of subject and object does not require an external synthesis or a composition of them, but their synthesis is grounded in their negative relation to each other. They are united as opposites insofar as their opposition, or mutual negation, means that each one is essentially determined *only* through its negative reference to the other. Productive activity is the performing of a contradictory or *negative unity* of subject and object, of society and nature — a unity of the opposites *as* opposites.

For Hegel, any subject-object dualism is nothing but a dogmatic position. No objectivity and no subjectivity exists as a primordial state of the "Being". Instead of presupposing a metaphysical objectivity, *objectivity* is seen as the outcome of an active, practical material processing. At the same time, no *subjectivity* is ever conceivable *before* an individual's active engagement with the natural, material world. According to Hegel, practical activity cannot be understood merely as a process of the externalisation of a subject and its subjective representations, it is not a "hylomorphic" relating of an active, form-giving individual to an inert amorphous matter (cf. Ingold 2013: 20), but the production process of both subject and object *as such*, i.e., as *determined* elements of a contradictory relationship (cf. Hyppolite 1974 [1946]: 301). It is only within the productive practice (the performance of a technical act) that subject is *practically* constituted *as subject* against an *Other* — against an *object* that is likewise constituted through *the same* practical relation (Hegel 1986b [1807]: 145–155; cf. Ley 1972).

For Hegel, practice is an ontogenetic moment of both subjectivity and objectivity, a process of generating (in his own philosophical language: a

process of "positing" [setzen]) the subject and the object as ontologically discrete substances. Labour, as the subjective expression of the deployment of practical activity, denotes the halt of the immediate satisfaction of a desire, the halt or delay of the immediate consumption in favour of a transformation of nature (matter). According to Hegel, the immediate satisfaction can be seen as the behaviour of a mere animal organism, and labour as the behaviour of a developed, rational self-consciousness. Through labour, the individual comes, for the first time, into the field of the objectivity as a *constitutive* force of this objectivity. Labour, as a transformative act, produces for the first time the world itself as an *object*, i.e., as a form different from the subject and opposing to it. The object, as a material form, is modified into another form and, whereas on the level of immediate satisfaction, nature was nothing but a content that was *annihilated* at the very moment of the satisfaction of the desire, on the level of transformative labour nature, for the first time, reveals itself as it *resists*. As Hegel argues in the *Phenomenology of spirit*, the labouring individual "relates himself [...] negatively to the thing, and sublates it; but, at the same time, the thing is independent for him, whose negating of it, therefore, cannot go the length of being altogether done with it to the point of annihilation; in other words, he only *works* on it." (Hegel 1986b [1807]: 151). Contrary to the satisfaction of the immediate desire, which annihilates both the desire as such and the thing, i.e., the object of reference of the desire (insofar as the *only* determination of the thing was to be *part* of the desire and thus thoroughly included in the abstract subjectivity of the living organism), the processing of the thing reveals, for the first time, its independent nature as a *material form* that can never be thoroughly sublated, but only *transformed* by the labouring individual. The immediate desire leads to its own "disappearance" (at the moment of its satisfaction) and, together with desire, the "*objective* side" also disappears (Hegel 1986b [1807]: 153), i.e., the object whose mere determination was the immediate satisfaction of the desire. To the contrary, labour is "*inhibited* desire, *arrested* disappearance" (Hegel 1986b [1807]: 153). Through the transformative action, "the negative relation to the object becomes its *form* and something *permanent*, because it is precisely for the labourer that the object has independence" (Hegel 1986b [1807]: 153–154). Labour is thus raised to the status of an ontogenetic moment of reality; not the abstractly knowing consciousness, but the practically active self-consciousness produces for the first time both the world and the human as concrete extremes of an ontological dipole, as *posited* object and subject.

In the early unpublished works of his Jena period, Hegel emphasised the essential role of labour in the externalisation of the individual, i.e., in the transformation of subjectivity, through his own practical activity and the production of a world of material culture. According to his definition:

"Labour is the this-worldly [diesseitig] making oneself into a thing" or "making oneself into an object" (Hegel 1987 [1931]: 189; for further discussion, see Habermas 2017 [1968]; Schmidt am Busch 2002). Through labour, as K. Kosik maintained, the subject is transformed into an objectively real existence: "the objective character of labor is a manifestation of man as a *practical* being, i.e., of an *objective* subject" (Kosík 1976: 122). Labouring is thus a real, material form of self-reflection, a reference or a relation of the self to its own self, and the totality of labour is an actual form of *self-consciousness*. This remark by Hegel is one of the most important contributions to the de-mystification of the "I" and the concepts of "self" and "self-consciousness" insofar as it relocates the individuality and subjectivity from the field of the abstract thinking "I" to the real field of human material practical activity. In his earlier writings, however, objectivity as an ontological category remains implicit and unthematicised. If subjectivity is constituted *as* subjectivity through a process of reification, through "splitting up the I" (Hegel 1987 [1931]: 189), objectivity, as an ontological form that is non-reducible to the subject and opposes it, does not seem to be explicitly recognised as a form posited and developed by practical activity itself. It is only in the *Phenomenology of spirit* where Hegel highlighted, for the first time, objectivity as emerging through labour, as constituted by practical activity.

Nevertheless, the reference to the ontological role of practice certainly does not imply any kind of "metaphysic of practice" independent from the cognitive intertwining and epistemic entanglement of consciousness with the world. And maybe the most radical aspect of Hegel's theory is that it puts practice at the very centre of the epistemological question of consciousness. For Hegel, the actual differentiation of the reality in subjects and objects is neither metaphysically given nor a mere categorical content of theoretical knowledge, but emerges in and through the mutually transformative and constitutive practical relationship between human and nature. A person cannot know what he is in himself before he develops practically his own "Being" within the world (Hegel 1986b [1807]: 296–297), and, equally, cannot know what the object is in itself before its practical entanglement with human subjectivity. Moreover, if mere theory divides the *knowledge* from the *object of knowledge*, the practical, transformative action both *posits* and *sublates* the inherent *asymmetry* of the goal (as an epistemically posited subjective concept) and the reality (both as "original essence" and objectively realised goal). In one of the most comprehensive excerpts from the *Phenomenology*, Hegel emphasises the unique role of practice, as a *totality* of action, in positing and overcoming the inherent cognitive asymmetry between the concept (in the form of an goal) and its reality (in the form of a processed, realised goal):

> Consciousness must act merely so that what it is *in itself* may become explicit *for it*; in other words, action is precisely the becoming of the Spirit *as consciousness*. What the latter is *in itself*, knows therefore from its actuality. Accordingly, an individual cannot know what *he is* until he has made himself an actuality through a deed. However, this seems to imply that he cannot determine the *end* of his action until he has acted; but at the same time, since he is consciousness, he must have the action in front of him beforehand as *entirely his own*, i.e., as an *end*. The individual who is going to act seems, therefore, to find himself in a circle in which each moment already presupposes the other, and thus he seems unable to find a beginning, because he only gets to know his original essence, which must be his end, *from the deed*, while, in order to act, he must have that end beforehand. But for that very reason he has to start *immediately*, and, whatever the circumstances, without further scruples about *beginning*, *means*, and *end*, proceed, to action; for his essence and his *in-itself-being* nature is beginning, means, and end, all in one. (Hegel 1986b [1807]: 297).

Practice breaks the vicious circle between the pre-desired goal, the circumstances, the means and the result, and gains both ontological and epistemological precedence over the analytic theoretical knowledge of its elements. Practice does not merely confirm or refute the truth of a theoretically pre-conceived reality, as Engels understood it in a rather "vulgar" materialistic way (Engels 1962: 276) a few decades later, but represents an epistemologically relevant event, as long as knowledge is conceived *from the beginning* as practically posited and not as a mere theoretical abstraction or "contemplation" (Kosík 1976 [1963]: 9).

Hegel links for the first time in the context of modern philosophy the technical-productive practice with the epistemological problem of consciousness. Practice *conditions* knowledge not simply because it creates a necessary "distance" between the subject and the object, as E. Cassirer (1985 [1930]: 59-61) believed, nor because in it the "truth" of the "Being" is revealed through a pre-conceptual, immediate experience, as it is implied by the neo-romantic view of Heidegger (see e.g., Heidegger 2000b; cf. Dreyfus 1991, 2013). Then again, Hegel does not deny theoretical knowledge nor suggests practice as an alternative source of knowledge or cognition. What he argues is that knowledge is always *practically situated*, insofar as the *actual "Being"* is only the *transformed "Being"*, i.e., that which has been practically developed as an actual *relationship* between the subject and the object and not merely conceived as an abstract metaphysical substance. Through practice and within practice becomes concurrently possible the knowledge of the object and self-knowledge. On the one hand, as Hyppolite construes the Hegelian position, "it

is only through what we do [...] that we learn what we are" (Hyppolite 1974 [1946]: 305). On the other hand, the only objectivity *for* the subject is the one with which it has been practically engaged. As K. Kosík argued, "in order to know things in themselves, man has to transform them into things for himself; to know things as they are independently of him, he has to subject them to his praxis; to find out how they are without his interference he has to interfere with them. [...] Man knows reality only insofar as he *forms* a human *reality* and acts primordially as a practical being" (Kosík 1976 [1963]: 9). Within practice, "the labouring consciousness comes to see the independent Being [of the object] *as its own* [independent Being]" (Hegel 1986b [1807]: 154). Practice shows that "Being" can be known only as *being transformed*, as developed through the practical relation of subject and object. The "original essence" is to be known only as practically developed.

If the human is constituted as subjectivity in its *negative* relation to objectivity, then practical activity modifies the essence of subjectivity both *cognitively* and *ontically*: within practice, the human comes to know the object in its development as well as his own developed self. He knows the object as a multiplicity of material affordances and himself as a network of possible references and correlations to the (previously non-thematised) object. Practice is the only active affirmation of the *concrete totality* of the natural and the cultural. It constitutes them concurrently as *different* and *identical* — each one is transformed into the other and simultaneously returned to itself by abstracting from the totality through the active, practical opposition to the *other*. Practice manifests the *constitutive material engagement* of subject and object, and also their mutual mediation — a process of *materialisation of the subject* and *enculturation of the object* (cf. Miller 1987: 19–33). The dialectic of practice makes up, therefore, the principal field where ontology and epistemology, the "Being" and its knowledge are intrinsically entangled. Practice re-states the questions of ontology and epistemology from the level of abstract reason to the level of actual practical activity. Marx's assertion that while man "acts on nature and modifies it, at the same time he modifies his own nature" (Marx 1984 [1867]): 192), M. Mauss' anthropological maxim that "[man] creates and at the same time he creates himself; he creates at once his means of living, things purely human, and his thoughts written in these things" (Mauss 2005 [1927]): 49), and Pfaffenberger's claim that "when we engage in technological activities, we construct not only artifacts, but ourselves as well" (Pfaffenberger 1999: 161), or even the post-phenomenological position that "we make things which in turn make us" (Ihde and Malafouris 2019: 196) — all of the above draw, implicitly or explicitly, back to the previously discussed ideas from Hegel's *Phenomenology of spirit* (cf. Kojève 1980 [1947]: 52), and view technological practice not as

a mere *object-making* process, but as an essential *object-subject-generating* procedure.

Nevertheless, if ontological dichotomy (the positing of the subject and the object) is the *outcome* of practice, then the question of the sublation of this dichotomy becomes an intrinsic question of the developed practical activity itself. For Hegel, the sublation of the dualism of technical practice does not mean to *fuse* or *externally* synthesise the subject and object. This would retain them as ontologically distinct and make their unity an ontologically indifferent condition. For dialectics, the unity of subject and object inheres in themselves and more concretely in their relational nature. Hegel's definition means to conceive subject and object as *negatively united*, i.e., to recognise their opposition, their mutual negative reference to each other as the real, immanent, and constitutive ground for their unification. The unity inheres in the logical determination of the subject and the object. If the only definition of the subject is *not to be* an object and of the object *not to be* a subject, then their *positive* content emerges only in the form of a mutual *determinate negation* (cf. Hegel 1986b [1807]: 68–81). Their *negative unity* thus has precedence over the abstract conception of them as separated. This is the concrete form of their relation and shows that only their mutually negative activity can affirm their ontological integrity as distinct substances. The ontological field is conceived, therefore, by the dialectics *monistically*, although not in the form of a metaphysical substance (i.e., of a stabile, immovable, and eternal being), but as an inclusive *activity* or as a *negation of the negation*: as deployment of the activity of a subject that conceives himself as a *negation of the object*, which is, in turn, conceived not merely as an alien being but as a *negation of the subject*. More simply, the self-reflective subject acts not against an alien Other, but *against its own self*, insofar as the Other is rationally recognised as a *negation of the Self*.

The rational organisation of human activity, far from being an abstract teleological positing or a mere form-giving activity, has already overcome *in thought* the dualistic form-matter contradiction when it lays a concrete *work-plan*. Laying a plan does not mean simply to posit a goal that will be achieved by means of the manipulation of a suitable inert matter. On the contrary, it means to conceive *from the beginning* the agentic dynamics of matter (of the object), i.e., its *negative* reference to the planning and acting subjectivity. From such an inclusive perspective, negating the object (by transforming it) means *negating it as a negation of the subject*. The *reference to the object* becomes a *self-reference of the subject*, which has, however, no more the form of an abstract, detached subjectivity, but has incorporated in itself the negative determinacy of the object. The development of practical activity reveals, therefore, two important aspects. First, that subject and object are mutually

constituted through their negative reference to each other, and that they have the immanent reason of their unity in their own selves, i.e., in their negative inter-determinacy, and not in any subjective, external act of synthesis, namely, not in an activity that externally *mixes* them. Second, the planning of the activity does not mean to posit a goal *against* an alien objectivity, but to have integrated objectivity in the subjective goal as an intrinsic determinacy of it *from the beginning*. This means that in order to plan an activity, one has to think about the totality of the practice, to reflect on the mutual negative reference of subject and object and thus to conceive the subjective deed as a *negation of the negation*, as a subjective-objective activity that prioritises neither the subject as a goal-positing authority nor the object as a causally dominating objective reality, but the relation of both, or, in other words, the activity itself.

The main question, therefore, is the following: if subject and object are not only externally or metaphysically independent constituents of technological practice but intrinsically united as *mutually opposed* and thus *mutually determined* moments, where is this *relational unity* of these *relational entities* to be *materially* found in the technological practice itself (i.e., beyond the abstract preconception of practical activity in the form of a work-plan)? How is this relationship materialised within the material process *par excellence,* which we call "technology"? Moreover, where can be *materially* found in the technical universe the determination of the subject as a *negation of the negation*, apart from his abstract thought as a work-planning individual? An immediate answer would be that the unity of the subject and the object is materially expressed in the form of a particular work, specifically, of an *end product*. Indeed, the product stands for such a candidate. Nevertheless, it must be considered only as a *formal* expression of the relational unity of subject and object that misses something very important. In reality, the product expresses the cessation of subject-object's relation rather than the *relation itself*, insofar as it removes itself from the cycle of technological practice as it is produced. In the concept of the product, subject and object are indeed conceived as negatively united, but they are no more conceived as *active*: the labouring subject has been sublated into "dead labour", and the initial nature, which agentically co-determined the technical process, has been sublated into the fixed, permanent material form of the particular end product. In order to approach a better solution, let us consider for one more time what practice actually brings forth.

The immediate outcome of practice (or labour) is a particular work or end product. The product is conceived on the one hand as an expression of the real merging of subjectivity and objectivity, while on the other hand it makes for the first time possible the *conception* of subjectivity and objectivity as actually negative to each other. If subjectivity and objectivity are *opposites*, it means

that they are, first, different from each other, and, second, identical to each other, or *negatively united* insofar as the only possible determination for each one of them is the *negation of the other* (what is subjective *is not* objective, and vice versa; each one is presupposed and *included* negatively in the conception of the other). The product is thus the real existence of the abstractly conceived dialectical relationship of subject and object, a true synthesis of both, which sublates their dichotomy and merges them into one singular substance. Even so, the completion of a practical process and the creation of a particular product generates a new circle of dialectical problems and antinomies. The subject and the object as they are reflected in themselves through the product are not any more the *actual beings* that they were within the practical process itself. They have been sublated in the product, i.e., they have ceased to be actively interconnected — now they are only theoretically conceived as the *abstract presuppositions* of the end product. That means that the product expresses only *formally* the unification of the subject and the object (their negative unity); their contentual dimension, their *processual negative unity within practice* has been left aside. The subject and the object are abstractly conceived as metaphysical substances that remain *outside* of the product. Subject and object are conceived as independent of their inherent active relationship and inter-determination. While human and nature are brought together and merged logically in the product, they are rehabilitated as pure opposites that remain outside of it. Their unity belongs only to an external form. The overcoming of this dualistic opposition, the true unification of human and nature and the elevation of human consciousness to the level of a self-consciousness that conceives the identity with itself as the unifying return from the opposition to nature (i.e., as a *negation of the negation*, as a negation of nature as negativity) has one more crucial (logical as well as factual) presupposition: the creation of a special product whose concept will be able to embrace the subject and the object as actively interrelated and negatively unified beings within the practice itself. This product is the *tool*.

For Hegel, it seems that the relational unity of subject and object is to be found *contentually* first and foremost in the means of production, whose most elemental concept is that of the tool. If subject and object are the *logical extremes* of the technological practice, the tool is the *middle term* that unites the opposites while mediates each one's reference to the other. Between man and nature, tools are determined to unite the extremes in a socio-materially concrete form of acting. According to this view, tools are not understood as externally intervening substances in the technological practice, but emerge through its own development. They make up an inherent product of the developed dialectical relationship of subject and object and a critical structural element of this relationship. They essentially include in their concept the

subject and the object not as independent substances but as interrelated active beings. Tools do not escape from the technological practice and have no meaning, no essence, and no determination outside of it. The anatomy of their *logical structure* can reveal the essence of technological practice as a *concrete totality* of subject-object's constitutive relationship. A theory of the tool and the philosophical investigation of its essence is thus a necessary presupposition for understanding the essence of technology as a socio-material totality that posits and sublates dualism between subject and object.

PART III

The Subject, the Object, and the Logical Structure of the Tool

Although "tools" have always been at the centre of the empirical investigation of archaeological and anthropological research, the theorising of the concept has been sporadic, if not entirely absent. Following the initial consideration of technology in the nineteenth century, and Childe's attempts to establish an evolutionary classification, tools were forced to the forefront of anthropological research in the 1960s, most notably through the work of A. Leroi-Gourhan. For him, tools were not only created and used by human beings, but intervened in their own evolution from *pithecus* to *homo*. He argued that the "enmeshing of tools and gestures in organs extraneous to the human has all the characteristics of biological evolution [...]. The hand, already formed in the monkey, stops changing [...] from the moment it begins to hold a tool" (Leroi-Gourhan 1993 [1964]: 242, 251). Leroi-Gourhan's naturalistic account conceives tools in an instrumentalistic and dichotomic way, insofar as they are only considered as an *external means* possessed by man and used for his purposes. Onto-technological dualisms, such as subject (as intentional being) and nature (as passive material), or subject (as skilful being) and tool (as passive mediator of human intentions to raw nature) are always in play. With the exception of a few recent works by French anthropologists (e.g., de Beaune 2008; Sigaut 2012), who have tried to approach the tool as such and analyse its essence as a mediator of the human-nature relationship, the tool still remains a theoretically unthematised concept in modern Western archaeological and anthropological literature.

Nevertheless, the poor theorising of technology has been by no means a peculiarity of archaeology and anthropology. Firstly, it was philosophy itself that slowly turned to the question of technology as a discrete field of theoretical research (Dusek 2006). The term "philosophy of technology" is one of the most recent in the philosophical vocabulary, used for the first time in the late nineteenth century in E. Kapp's *Basic lines of a philosophy of technology* (1877). Over the course of the following century, it has been transformed from a simple question to a real branch of philosophical studies. With few exceptions, the first major works on the history and philosophy of technology were made in the 1970s, most notably in American philosophical literature (Carpenter 1978;

Jonas 1979; Ihde 1979; cf. Durbin 1998), and followed up in the next decade, predominantly in the English-speaking world, by the formation of STS.

Modern philosophy has paid little attention to the question of technology, while the tool itself remained thoroughly exiled from the field of logical analysis having been discredited as a philosophically trivial concept. Kantian philosophy — one of the most important philosophical currents for the formation of the conceptual schemes of late modernity — has never engaged with either the concept of technology or with the tool. Only in his paper, *Form and technology* (1930), did the neo-Kantian philosopher, E. Cassirer, thematise the tool as an expression of spirituality. For Cassirer, the tool represents, along with language, the most decisive differentiating feature between man and animal (Cassirer 1985 [1930]: 50–51). It constitutes an immediate product of human intelligence in order to fulfil his own *purposes* in the world. The invention of the tool extends the essence of man beyond his own corporeality. Besides its importance as a *means* in human-nature relationships, Cassirer also stressed its crucial epistemological significance, insofar as tools do not only transmit human aims to an external object, but establish a real *distance* between subject and object, which is a crucial presupposition for knowledge itself (Cassirer 1985 [1930]: 61). Even so, Cassirer's understanding can hardly escape formalism. The conception of the tool remains subjectivist and instrumentalistic. In its essence, the tool lacks any objectivity, insofar as it is not conceived as embracing both the subject and the object. It remains further trapped in the dualism between *means* and *ends*. The dualism of subject and object is duplicated in a *nature-tool* and a *man-tool* dualism, which understands technology and practice as an amalgam of *external* relations.

In the post-Kantian era, there has seldom been any systematic effort to approach the question of technology and understand the logical implications of the tool concept. Except for a few aphorisms of the eighteenth century romantic thinker, Novalis, the tool only became a subject matter of philosophy in a series of early, fragmentary and unpublished manuscripts of G.W.F. Hegel from the late eighteenth-early nineteenth century. Philosophy's dispassion against the tool remained almost unaltered until the time when M. Heidegger, in his major work *Being and time* (1927), tried to define its logical depth, raising it to a constitutive conceptual determination of the Being-in-the-world. Yet Heidegger conspicuously avoided the concept of the tool when he attempted, more than two decades later (1953), to deal with the question of technology *per se* (Heidegger 2000b [1953]).

Hegel and Heidegger might be the only philosophers of modernity who have attempted to outline a philosophical discourse for the tool as a constitutive element of human's practical activity. Heidegger's conception can be sporadically found as a reference in a few contemporary works on the

anthropology of technology, as well as in earlier texts on the philosophy of technology. On the other hand, Hegel's analysis of the tool remained until now almost entirely ignored, although it represents a unique conception with critical implications for an anthropological and philosophical comprehension of technology.

III.1 Heidegger's phenomenology or the tool as not a tool

Heidegger ascribes to the tool two crucial ontological determinations: *readiness-to-hand* (Zuhandensein) and *presence-at-hand* (Vorhandensein). These constitute the two aspects of a tool's "Being" within the world, and describe the ontological play between *things* (as beings *actively* integrated into a limitless network of relations or determinations) and *objects* (as detached from any context, isolated, quantified, present substances) (cf. Harman 2002: 31; Knappett 2008: 142–145). According to Heidegger, the active use of a tool *as a thing* makes it invisible or transparent to human consciousness. Its functionality thoroughly integrates it into the continuum of its relations, so that it becomes non-observable and non-penetrable by human understanding (Heidegger 2006 [1927]: 73, 75). The tool is "absorbed in the flow" of action and "withdraws" from human awareness (cf. Dreyfus 2013; Thomas 1996: 68; Verbeek 2005: 78-80). It is transformed into a specific *object* (i.e., into a thing *for* the consciousness) and into a presence *against* a subject *only* when it "breaks" or "malfunctions", and so is expelled from the sphere of functionality and usability. It thus turns into a non-utilisable, deficient, merely present being (Heidegger 2006 [1927]: 73). It is only the lack of any usability that breaks down the tool's determination as a means for the transformation of a raw substance (Heidegger 2006 [1927]: 74) and thus drags it up from the continuum of actuality to the light of the present. At that moment, the "broken tool" becomes *visible* for the first time (cf. Harman 2002: 45).

One immediate question that arises is whether Heidegger's conception of the tool and the analysis of the tool's relation to the subject represents a rigorous philosophical argument or a psychological explanation. To my mind, it is hard to understand the concept of the tool's "invisibility" as something different from a psychological interpretation, expressed from a first-person perspective. And what guarantees that our first-person psychological experience, which makes a tool invisible for the individual labouring consciousness, indeed reveals the true essence of the tool, of technology, or even of the "Being" in general? The most problematic aspect of Heidegger's view, however, lies in the broader logical consequences of its argument. I believe that Heidegger's thesis can hardly avoid a logical and epistemological dead-end, hence its transformation into a logically inconsistent pragmatic agnosticism according

to which the only possible knowledge of the tool *as a tool* is its knowledge *as not a tool*. This problematic dimension of Heidegger's tool concept was underlined by D. Ihde who, in 1979, argued that "the *negative* way in which the instrument emerges from transparency in use in his analysis casts a sense of disvalue upon any positive thematization of an instrument" (Ihde 1979: 28). For Heidegger, it is not the active, practical interweaving of man, tool, and nature that generates subject and object as concrete and determined *through* their active opposition. On the contrary, practical activity seems to homogenise the "Being" and assimilate any difference between the acting individuals and the material objects. Categorical distinctions between the beings (first and foremost between the subjects and the objects) can only be drawn by a detached theoretical perspective, while practice *as such* develops without shaping any ontological differentiations. Practical activity is guided by a "prereflective cogito" and through a "prereflective monitoring" (Dreyfus 2013: 32). Any categorical differentiation, such as between a labouring subject and an object-to-be-transformed, concerns only a reflecting consciousness that can only arise outside of the practice itself. As Dreyfus claimed, "our absorption can suddenly end, and be replaced by *reflection*" only "when a familiar situation does not evolve in a familiar way" (Dreyfus 2013: 38). The practical level reveals an unlimited ontological uniformism of the "Being", while categorical divisions only seem to falsify that "Being" and are incapable of grasping its truth and essence. As a result, from this phenomenological perspective, no knowledge of a tool *as an actual tool* is ever possible. A tool at work cannot be known at all, insofar as it is immersed in the flow of "Being" and making. Within the non-determinable practical "field of forces", the tool is condemned to being non-graspable by any consciousness (cf. Dreyfus 2013). On the other hand, a broken or deficient tool that can be known as an object *against* a consciousness is *not any more a tool* in the strictest sense of the term. Just as the *tool-being* exists *only* as long as the tool is at work — immersed in the network of its hetero-relations that make it indiscernible from the labouring subject — the loss of its essential determination of the tool-being (through its breaking-down or malfunctioning or removal from a practical activity in general) means that any knowledge of it as a discrete substance is thoroughly expelled from the field of human awareness.

Despite the enthusiastic adoption of Heidegger's ideas by the symmetrical anthropological approaches, the tool as a *thing* — immersed in the indeterminate network of its hetero-relations — excludes any possibility of understanding it as a distinct element of the anthropology of material culture. If we follow a rigid Heideggerian approach, the concept of the tool as a discrete form of technological totality completely disappears in the ontological uniformity and indeterminacy of the "network" (see, for example, the case of

the "potter's wheel" in Malafouris 2008) — or, in more Heideggerian terms, in the "totality of equipment". A tool at the state of being-in-the-world remains an unthematised entity, immersed or absorbed in the totality of its hetero-relations. As Heidegger himself underlined, "being-in-the-world signifies the unthematic, circumspective absorption in the references constitutive for the readiness-to-hand of the totality of equipment" (Heidegger 2006 [1927]: 76). Heidegger's approach can be seen, therefore, to form an eliminating philosophical endeavour, which dissolves in the ether of "Being" the subject, the object, and the tool. Such an approach results in a transformation of the different elements into simple metonyms of the "Being". Rather than showing their interrelation and deep ontological interdependency, it *postulates* their identity as ontologically uniform beings, *abstracting* from their differences. Practice and hence technology remain a non-determinable continuum that can be *experienced* but never *consciously* thematised. Practice is not a field of confrontation between subject and object, and practical activity is not an active operation that constitutes subjectivity and objectivity through mutual interpenetration. Equally, the tool is neither a discrete substance nor a mediating mechanism of such a relationship. Subjects, objects, and tools are left to flow indeterminably within the field of an unthematisable "Being".

Contrary to such an eliminating approach, I believe that modern dialectics, as principally developed by G.W.F. Hegel, offers an alternative, dynamic, inclusive, and more logically consistent view of the concept of the tool as an expression of the concrete relationship between the subject and the object. Moreover, contrary to any reificationist or instrumentalistic views, Hegel emphasised the relational character of the tool and its actual nature as a logical recapitulation of the subject-object's relation, as well as a constitutive moment of both ontological variables and of the practical activity as a whole. Through the anatomy of a tool's logical structure, Hegel recognised it as the most critical material mechanism that sublates the ontological dualism, and transforms the technological practice into a firmly grounded self-mediated totality of human-nature relationship.

III.2 Hegel's tools: relationality, universality, and effectivity

Hegel's concept of the tool has remained, until today, entirely ignored by theoretical debates on the anthropology of technology. Occasional references to it can only be found in philosophical studies that deal with Hegel's concept of labour or practice (e.g., Habermas 2017 [1968]; Huson 1998; Ley 1972; Lukács 1975 [1948]; Schmidt 2007; Schmidt am Busch 2002). Hegel's conception of the tool does not constitute a part of his mature work. Instead, it belongs to his earlier philosophical endeavours of the Jena period and is to

be found only in unfinished or fragmentary, posthumously published drafts such as the *System of ethics* (1802/3) and the *Jena system drafts* (1803–1806). From *Phenomenology of spirit* to the *Science of logic*, the *Encyclopedia*, or the *Philosophy of right*, the scanty references to the concept of the tool, which is never again thematised as a real subject-matter of philosophising, do not reach the profundity of his earlier reflections.

Hegel's account builds a crucial de-reificationist critique of the tool. The tool is conceived not as a *thing* but as the material solidification of the *relationship* between artisan and matter. It is not a *third* ontological variable that is *added* to the productive practice, but "arise[s] out of the dialectics of labour", as G. Lukács (1975 [1948]: 328) stressed. It is a totalising moment of the developed relation and inter-dependency between subject and object. As H. Ley understood it, the tool is "becoming" and "transition" (Ley 1972: 272), it signifies the *process* itself. Through its activity, the tool "modifies the conditions and the persons" (Ley 1972: 273). Tools are thus the outcome of an ongoing relation and, at the same time, a mediating or transforming mechanism. They are directed *dually* towards the subject and the object.

For Hegel, the productive practice is the unfolding of a *singular*, *negative*, *elapsing*, and, hence, *contingent* relation between subject and object. A *singular labour* is interwoven with a *singular raw material*. As we have seen before, both labour and matter are in a *mutually negative relation* and vanish in the manufacture of the end product (Hegel 1967 [1913]: 20; cf. Hegel 1986b [1807]: 151–154). Neither of them can be retained, but disappear as soon as they are transformed into a concrete object of material culture. Each practical operation disappears just as it is accomplished and can never be repeated *as such*. Contrary to this form of immediate elapsing relation, the development of the tool signifies the emergence of a material element with the very determination of a *medius terminus*, a logical middle term, which mediates the relationship between subject and object (as logical *extremes*) and sublates their morphological opposition (Hegel 1967 [1913]: 20; cf. Hegel 1986a [1932]: 195). Hegel argued: "By means of this middle term the subject cancels the immediacy of annihilation" (Hegel 1967 [1913]: 20); and "the tool as such prevents human from his material annihilation" (Hegel 1986a [1932]: 228). While labour and raw material are singular and elapsing, and while each practical operation is singular, vanishing, and non-reversible, the tool is an "existing universality" (Hegel 1986a [1932]: 211) insofar as it encompasses the *general form* of *all* singular interrelations between subject and object (Hegel 1987 [1931]: 189). Whereas labour and matter are gone as long as they are transformed into an end product, the tool is preserved, and it remains identical throughout productive practice. It is "that alone which remains from the labourer and the processed substance" (Hegel 1986a

[1932]: 211), and it is its essential determination to be the universal form of the subject-object's concrete interrelation, or, as Hegel puts it, "in the tool [...] I have the possibility of conceiving content *as universal*" (Hegel 1987 [1931]: 189).

The invention of the tool offers to the subject the possibility of rescuing the general form of its labour from vanishing by overcoming the singularity of it: "in the tool [...] labour ceases to be something singular" and "subjectivity [...] is raised to the level of the universal" (Hegel 1967 [1813]: 20). The invention of the tool is thus not the configuration of a singular thing but "the invention of something universal", which transcends the singularity of different skilful individuals and can be replicated and appropriated through proper apprenticeship by other members of the community (Hegel 1986a [1832]: 228). The tool's essential universality entails thus, for Hegel, an inherent tendency towards the formation of specific *technological traditions*. The tool is a universal that "becomes rooted in traditions" (Hegel 1986a [1932]: 211). If the singularity and contingency of the unmediated practical relation of man and nature is raised to the status of a technological tradition through the infinite *repetition* of the same *singular technical performances*, the tool, as inherently universal, includes in its own essence (i.e., its own material form and logical structure) the concept of *tradition* as a morphologically concrete and universally preserved pattern of practical activity.

In one sense, the tool is a work-plan that has been thoroughly materialised, and, while it may be counter-intuitive, the materialisation of a work-plan is not the end product. As previously discussed, the end product is only a moment of the work-plan that, more precisely, signifies its completion and thorough sublation. The end product emerges after a work-plan has been instantiated and the whole procedure has been concluded. To lay a work-plan means to correlate in a specific way the subject and the object in a processual, active, practical relationship. But the work-plan as a kind of *pre-conception* of the relationship is nothing but the relationship caught abstractly in *thought*. Without the material tool, the relating of the subject to the object remains only a matter of abstract thought. Before the introduction of the tool, "the relation of the subject to the object" remains "utterly detached [from them], merely in the subjective, in the thought of intelligence" (Hegel 1967 [1913]: 20). Contrary to a work-plan, the tool is not an *external* and only *conceptual* element of the practical relationship of subject and object, but *belongs* to the practical relationship itself as an *immanent material* element of it. On the other hand, the practice is only a singular and elapsing instantiation of the subject-object's relationship. Instead, the tool is both an element of the elapsing practical activity and, at the same time, the materially stabilised universal form of this very activity that survives beyond it (beyond its completion and sublation).

For Hegel, this very nature of the tool allows for its evaluation as more important than both subject and object. As he stressed, the tool "stands as the middle term, higher than labour, higher than the object [...], and higher than enjoyment or the end aimed at" (Hegel 1967 [1913]: 20, cf. Hegel 1986c [1816]: 453, 1987 [1931]: 189). Against a singular desire, a singular end, a singular raw material and a singular end product, the tool is more valuable insofar as it encompasses in its structure *every* singular relationship between artisan and matter. The tool does not represent an *external* delimitation of labour, matter, or the end product but their *immanent* interrelation. As a consequence, while the subject and the object are in themselves only unilateral, abstract beings, the tool as a materialisation of their relation is equally *subjective*, as regards the *intentions* and *representations* inscribed in it; and objective, as regards its immediate reference to the object, to the nature as raw material. As Hegel argued, "on one side the tool is subjective, in the power of labouring subject, entirely determined by it, manufactured and fashioned; on the other side it is objective, directed on the object of labour" (Hegel 1967 [1913]: 20). In other words, although a tool, abstractly conceived, is nothing but a sensible thing, in reality, it is the only material element of the technical practice that fully expresses the subject-object relation; more precisely, the *relational unity*, the *negative unity* of the subject and the object.

Hegel's approach leads to some critical implications. Just as the tool expresses the relation of the artisan and matter, i.e., insofar as its concept presupposes both the subject and the object, its adoption means the adoption of a *concrete logical structure* and a *concrete relationship*. The tool becomes, according to Hegel, "the persistent norm of labour" (Hegel 1967 [1913]: 20). Its utilisation is the activation of its logical structure, and signifies a unifying and totalising moment of productive practice. As Lukács argued, Hegel's concept of the tool "implies a conception of the concrete totality of man's activity in the actual world" (Lukács 1975 [1948]: 322–323). It cannot be regarded as a *neutral* means for transmitting voluntarily generated subjective ends to an *external* object (cf. Hegel 1986b [1807]: 68–70). On the contrary, it is itself an *effective authority*, an *agentic mechanism* that determines the entire context of practical activity. As a *medius terminus*, it "fixes the extremes" (Hegel 1967 [1913]: 20), i.e., it *posits* its own *presuppositions*: it posits the subject *as* a concrete artisan, and the matter *as* a concrete material within the productive praxis. It determines the required motor skills and bodily gestures of the artisan *for* the tool, the necessary features that the raw material must have in order to be suitable for being processed *by* the tool, as well as the general morphological characteristics of the end product. Each tool posits a concrete identity, a concrete structural unity of artisan and raw material.

For example, a potter's wheel does not accomplish the transformation of clay in vessels in abstract terms, and it can hardly be regarded as an external means for transmitting the subjective ends to an external, detached raw material (cf. Kozatsas and Choleva, forthcoming). On the contrary, it presupposes distinctive motor skills and socially determined embodiments of action for its manipulation as a tool, as well as a long apprenticeship process (Roux and Corbetta 1990; cf. Sigaut 2011). Furthermore, it determines the characteristics of the ceramic fabric that is suitable for wheel-use (e.g., humidity rates, number, size, and morphology of temper inclusions) (cf. Nordquist 1995: 206; Rye 1981: 74; Sillar and Tite 2000: 5; Spencer 2010: 674), while it imposes a series of distinctive morphostylistic features on the pots that are necessarily determined by the vertical axiality and the angular momentum of the rotating table.[4] As M. Choleva has shown in a recent article on Aegean wheel-made pottery from the 3rd mill. BC, the introduction of the potter's wheel did "produce an artisan for the wheel". Moreover, it configured an entire new material and socio-cultural universe: "the wheel implies a different mode of production, which is nothing but a different, historically *determined way of life* that manifests the social reality into which the artisan becomes *what he is* with the power of a *traditional practice*" (Choleva 2018: 77).

Therefore, rather than being a neutral external means, the tool, from the moment that it is introduced in the manufacture, is raised to the status of a *normative authority* of craft practice that regulates the logical context of a historically patterned subject-object relation. Contrary to any commonsensical conception of the tool as a subjectively formed, in itself inert and only externally activated means, its configuration seems to signal the emergence of an immanent *normativity* in the sphere of technology. This dialectical normativity, however, refers neither to the presence of abstractly conceived objective or natural constrains (e.g., the environmental availability of specific raw materials), nor to the presence of abstractly conceived subjective socio-cultural values (e.g., taboos) that are considered to intervene *from outside* to the technological practice and be synthesised with an allegedly pure "technical logic". The tool's normativity is *immanent* insofar as it derives from a structure

[4] It has been argued that the invention of the potter's wheel in the 3rd mill. BC led, among other factors, to the proliferation and dominance of the symmetrical shapes of the late EH II Lefkandi I/ Kastri pottery group (as opposed to earlier non-symmetrical vessels, e.g., the EH I-II "sauceboats") (Kalogerakou, 2003: 205; cf. Nakou, 2007: 228). However, attributing effectivity to the tool does not entail in any way any kind of technological determinism of this form. The tool *affects* but *does not trap* the human activity in its own formalism. The point is (in the case of pottery) that the potter's wheel *indeed* produces necessarily symmetrical shapes (and, moreover, symmetrical shapes of a rounded plan). Even so, it does not necessitate the end products to be symmetrical. The potter can yet perfectly abrogate the symmetrical result of the wheel and produce a non-symmetrical shape. The point is that he is now *indeed compelled* (by the normative effectivity of the tool) to accomplish a certain set of technical performances in order to achieve this very asymmetrical result.

that has *ab initio* included the subject and the object as interrelated, inter-constituted beings.

These aspects reveal the dynamic, active role of the tool in the process of material production. The tool's activity is a particular kind of *effectivity* that transcends its mere capacity to transform a material. As a recapitulation of the subject-object's relation, the tool posits in a *normative* way a *categorical context* for the entire technical-productive practice. The tool's effectivity is the unfolding of its normative potential just as it is put into action by human labour. This effectivity is directed towards both the subject and the object, since its logical structure confines the abstract spectrum of technological possibility by establishing *morphologically concrete* relations between the subject and the object. As previously discussed, the tool *determines* in a normative way the characteristics of both the subject and the object if they are to be interrelated within a concrete technical activity. The effectivity of the tool is the deployment of its transformative potential not merely in the direction of the object but equally in that of the subject. As F. Sigaut argued, the tool is a kind of domesticated nature that, in turn, accomplishes the domestication of human itself:

> [T]he tool acts, although it is inert, the man only moves it. But to move it so as to obtain the desired result, he must learn not only the mode of action of the tool, but to control the movements of his own body. [...] I use the tool, but reciprocally the tool uses me, in the sense that it has its own requirements and that I have to yield. Otherwise, it will not produce the expected effects; it can even turn against me and hurt me. Working with a true tool implies a non-natural discipline of the body. The tool derives from the domestication of matter [...]. But this domestication is reciprocal. To take full advantage of the potential of the tool, I must also domesticate my own body, that is to say, teach it to perform movements that are no longer "natural" in the sense indicated above. (Sigaut 2011: 191–192)

In a similar way, the philosopher J.K. Feibleman, who, in 1967, proposed the provocative term "philosophy of tools", stressed the need to consider the very nature of tools that allow them to serve not only as a mere means directed towards an objective end, but as equally essential determinants of the ends and the technicians themselves. To his view, "the tools employed can enter into the business of aims", while, although it can be said that "men make tools, [...] in another and equally important sense, it is also true that tools make men" (Feibleman 1967: 332). Tools determine in a normative way both their use and the results to which they are aimed. As Feibleman further argued: "When men make a tool they commit themselves, to a larger extent than they recognize,

to the tool's existence, its aims and purpose, its need, so to speak, to be used in a certain way" (Feibleman 1967: 332). This position does not imply any kind of technological determinism, as I pointed out before with reference to the case of potter's wheel. It only posits a normative framework within which human agency, natural resources, and material products move, co-determine each other and co-develop. A tool's normativity, as I brought attention to above, is what can be said to lie below D. Ihde's "latent telic *inclinations* which are made possible through the use of instruments" and "favor certain rather than other directions" (Ihde 1979: 42). It is precisely a tool's normativity that is effectively enacted within its use that allows the emergence of certain "instrumental styles" (Ihde 1979: 43).

This idea of a tool's normative capacity and effectivity, which in the case of Hegel remains only implicit (though, to my mind, thoroughly consistent with the rest of his anatomy of the tool concept), seems to have a slightly longer history. The idea of a tool's effectivity, of its agentic character, can be found in a collection of textual fragments of Georg Friedrich Phillip von Hardenberg (commonly named *Novalis*), an important figure of the German Romantic tradition of the late eighteenth century. As Novalis mentions in a posthumously published band of aphorisms, the tool has effectivity, as it is "the vehicle of an alien deliverance" when it is put in action by human labour (Novalis 1981 [1965–1968]: 552). Consequently, "I cannot be effective with a tool in any other way than in that which its natural relations determine for it" (Novalis 1981 [1965–1968]: 553; cf. Novalis 1997 [1965–1968]: 63). Or in other words: "I feel myself confined by each particular tool to a special kind of activity" (Novalis 1981 [1965–1968]: 553; cf. Novalis 1997 [1965–1968]: 63). As J. Holland argued, Novalis prioritises the tool whereas he "decenters the agent and allows the *Werkzeug* [tool] to take its place" (Holland 2006: 623). Nevertheless, Novalis' reconsideration of the role of ontological variables in productive practice does not merely imply an alteration in terms of "priority", but rather a crucial, logical re-arrangement of the elements so that the tool is recognised — similarly to Hegel — as a real *medius terminus* of practical activity; as a subjective-objective relational essence that unites the negatives (the *extremes*) in practice. Thus, the tool is not simply a means for material transformation according to the subject's detached will, but directs its effectivity dually towards the subject and the object. As Novalis further stressed: "on the one hand every tool modifies the powers and thoughts of the artist that conduct it to the material, and, conversely, it modifies the effects of resistance of the material that conduct it to the artist" (Novalis 1981 [1965–1968]: 553; cf. Novalis 1997 [1965–1968]: 63).

The tool expresses thus the *totality* of practice. It is the logical synopsis of the unfolding of the practical activity. In this respect, the tool determines

the logical limits of a given practical activity. The logical structure of the tool confines both the artisan and the material within a specific kind of effectivity, and it locks a morphologically concrete relation between labour and nature. The craftsman's virtuosity and nature's affordances are embedded in the normative context posited by the tool.

The logical return of human labour to itself, the return "to itself from reification" (Habermas 2017 [1968]: 26), and the sublation of dualism between human and nature is expressed by the tool's place as a morphologically active being. The tool is the material expression of the *negation of negation*, i.e., an active affirmation of human practice as *inclusive activity*, which directs itself not simply *against* nature — as an alien, external being — but against nature as a negation of the subject. The negation of nature thus becomes a self-negation of the labouring and work-planning subject, the relation to nature a self-relation, insofar as nature has been *ab initio* recognised as a determinant of subjectivity. Human labour is raised to the level of a practice that consciously considers its integral relation to the object and thus does not simply *work,* but builds, moreover, its own *means of labour*, i.e., products that incorporate in their own essence and determination the antithetical unity of subject and object within practice. Although the end product could be seen as a unification instance for the subject-object's negative relation, it represents only a singular being — the outcome of a singular productive act — which has both labour and matter *outside* of its very nature. As already stated, in the concept of the product, the subject and the object are no more conceived as *actively interrelated* but as sublated. On the contrary, the tool *is* this relation, i.e., a materialised universal form of the subject-object's negative inter-reference to each other.

The emergence of the tool signifies the completion of the subject-object's relation in the form of a practical totality. Labour, as an *immediate* act, transforms both subject and object into beings *for themselves*; the subject experiences the consolidation of its subjectivity as negativity against the object that it processes, as well as the consolidation of the object's objectivity as a being that *resists* and cannot be annihilated but only *transformed* (Hegel 1986b [1807]: 153–154). This abstract negativity of *immediate practice* posits the subject and the object as mere *negatives* and *externals* to each other. Human *is not* nature and nature *is not* human. However, insofar as subject and object refer negatively to each other, they *depend* on each other in order to posit their own essence. Their *inter-dependency* is their most essential nature. On the contrary, highlighting this inter-dependency of both is nothing but a subjective consideration of them as *united*, though "merely in the subject, the thought of intelligence" (Hegel 1967 [1913]: 20). In reality, they remain external as mere opposites. The development of the tool makes for the first time possible the material assimilation of their dualistic confrontation, and posits their unity as

actually real; not contemplatively but *materially* and *practically*. The tool *is* the *negative unity* of subject and object, as interrelated beings, in the field of material practice itself.

To sum up, Hegel's anatomy of the logical structure of the tool highlights a series of logical determinations as critical features of its concept:

1. The tool is the materialisation of universality and necessity of any singular and contingent practical relation between the subject and the object. It preserves the general form of the subject-object's relation against its various singular instantiations. The tool as universal consolidates the technological traditions, and provides them with a concrete material reference.
2. The tool is a *relation* and not a *thing*. It is the material expression of the practical relation between the subject and the object, and not a third additional ontological variable of the practical activity. It *mediates* the relation of subject and object, since it includes them in its logical structure. In the concept of the tool, subjectivity and objectivity are necessarily *co-conceived*.
3. As a logical *medius terminus*, the tool is both subjective and objective. It recapitulates the practical relation of man and nature not as immediate (and hence merely negative or abstract) but as mediated and thus determined, inclusive, and concrete. If the subject, in the immediacy of productive praxis, is the negation of the object, the tool is the *negation of the negation.* It is a firm expression of a subject's return to itself that includes in its concept and awareness *its own relation* to the object, not in the form of an abstract opposition, but *as its own constitutive determinacy*.
4. The tool, as a recapitulation of the relation of subject and object, has *effectivity* that directs both towards the subject and the object, and thereby becomes a normative principle of technological practice. It posits the artisan as a morphologically determined subject and the matter as a morphologically determined object. Human and nature do not meet in the practical process as abstract metaphysical substances, but as interrelated determinacies *through* the tool.
5. As equally subjective and objective, the tool suggests the concomitant constitution of subject and object. The *invention* of a tool is not the formation of an external means for transmitting subjective ends to an inert, external object, but expresses the mutual determination of the artisan and the raw material through it. The only nature or the only matter that exists *for* the subject (as a practically active subject or artisan) is the one that has been *ab initio* conceived as constitutive of and related to its own intentions. Conversely, intentions are inextricably determined by natural determinacies and material affordances. The tool encompasses this mutually negative relation and the assimilation of dualism itself insofar as it consolidates the

negativity into a form of morphologically constant unity. The invention of a *new tool* coincides with the configuration of a radically *new artisan*, with new mental representations, motor skills, social needs, and cultural norms, but equally of a *new raw material* (a determined raw nature *for* the tool) that has been *ab initio* coalesced with the subject and being inherent in the logical structure of the means. I cannot invent the potter's wheel without inducing *at the same time* radical changes in my own conceptual universe and its embodied expression as a package of discrete and complex motor skills and social references. I cannot invent the potter's wheel without inducing *at the same time* radical changes to the object itself. The emergence of the tool signifies the concretisation of practical activity by inducing a *holistic shift* of the technological sphere.

Epilogue

Hegel's dialectical theory of practice, most notably his relational conception of the tool, proposes a reconsideration of the entire context of "technology". His view opens up the possibility for an anthropological theory of technology that can go beyond all forms of modern dualism and the neo-romantic monism of material social life.

As we have seen, neo-positivistic and post-modern approaches to technology deal with the categories of human and nature analytically as beings *in themselves* — as discrete substances that only come into play as external, integral, and impenetrable substances. In this dualistic framework there is scanty logical space for considering tools in their own right. Whenever tools come into play, they are considered subjectively as material carousels for the transmission of a subject's ends to a foreign nature. Throughout the course of the twentieth century, many French and American anthropologists tried to cope with the logical problems of the neo-positivistic view, challenged the consistency of analytic dualism, and underlined the socio-cultural character of technical activity and the inherent interdependency of the subject and the object within it. From this perspective, subject and object were recognised, for the first time, as substances that posited their own integrity through active, practical negation of the other. Technological practice is thus considered as a synthetical process between the subject and the object. The production of material culture is realised through technical processes that merge the socio-cultural elements with the objective, material determinants. Culture and nature are inextricably entangled and co-existent within practice.

Beyond analytic and synthetic dualism, as well as beyond many recent phenomenological or constructivist approaches that urge for the thorough levelling of any ontological difference between the subject and the object, Hegel's approach suggests a different theoretical framework for understanding technology as a socio-material process that actively recapitulates — posits and sublates — *dichotomy* and *unity*. According to this view, there is no need to dogmatically *presuppose* any kind of metaphysical monism in order to rehabilitate the unity of the subject and the object within the field of practical activity. For Hegel, the unity of the ontological field is not metaphysical, but relational and dynamic, and is founded in the constitutive practical opposition of the subject and the object. The unity inheres in the negativity itself.

Within this framework, Hegel's logical anatomy of the tool appears as one of the most critical aspects of his argument. The tool illustrates how technological practice creates by itself the conditions for the organic unification of human and nature. Considering technological practice through the relational and

effective being of the tool enables a consideration of technology as a totality *in and for itself* — as an all-embracing activity that unfolds the intrinsic unity of human and nature as acting opposites. Dualism is overcome *within* practice as we turn the emphasis of the theoretical discourse from material culture as a *product* to material culture as a *means of production,* whose most elementary concept is that of the tool. While Dietler and Herbich (1998: 235) argued for the need to shift interest *from objects to processes*, Hegel's account underlines the need to shift the interest towards the tools as expressions of the processes themselves, as material forms whose sole determination is the reproduction of these processes. Moreover, Hegel's approach underlines the relational and dynamic nature of the tool, and its emergence as a radical moment of concurrent transformation of human and nature. Man constructs nature and nature constructs man through the creation and appropriation of tools. The invention of a tool designates an holistic fact that rearranges the subject-object relationship and re-posits it in a new concrete form.

The relational character of the tool means that it cannot be learned or mastered outside of the material practice, i.e., outside of the activity itself. It must be put into action in order for its use to be revealed. Mastering a tool means *conforming* both the material and the craftsman to its normativity, *bonding* the person and the object *by means* of it. The potential of a tool is discovered through repetitive practice and participating in a lengthy process of apprenticeship within structured socio-material spaces of activity, i.e., socially organised and culturally laden spaces of active co-existence between people, tools, and things — in other words, within well-established communities of practice (Wenger 1998). It is only within their *use* that tools reveal their *affordances* (*sensu* Knappett 2004, 2005), namely, their relational and situated qualities. Nevertheless, tools are not mere *things* but *relational material forms*, insofar as they include in their concept both the subject and the object as intrinsically interrelated beings. Therefore, their utilisation, i.e., the deployment of their potential, is always twofold. Tools, as transformative implements, disclose both the relational affordances of the material objects processed with them and the relational affordances of the persons who use them, i.e., their skills and desires. The activation of a tool's affordances entails the creation of new contents within the material world and the configuration of new skills and skilful performances of the labouring individuals.

The intrinsic relational character of the tool and its unique mediating role in the field of human practical activity makes its concept indispensable for interpreting technological phenomena. The tools are neither mere extensions of acting subjectivity nor mere objective beings that deterministically impose their material potential on human action. As F. Sigaut emphatically underlined, "it is equally misleading to confuse the tool and the material under the pretext

that they are both materials, as to assimilate the tool to the man, because they are both acting" (Sigaut, 2012: 100). Tools must be understood and theorised in their own right as material forms of the posited negative unity between human and nature, i.e., as instantiations of a humanity that conceives itself, implicitly or explicitly, as including the opposing relationship between itself and the world.

Hegel's approach to the concept of the tool can have critical methodological implications for the contemporary archaeological and anthropological study of technology. A "tool-oriented" archaeology or anthropology of technology means the adoption of a new way of classifying and interpreting material culture. Placing emphasis on the tool-character of a significant part of the material culture means to understand how persons, social groups and communities create relational bonds between themselves and the objective world, how human beings subjectify themselves and objectify the world through forms of patterned practical activity. It means to trace out how the various forms of synergy between culture and nature are materialised, stabilised and regulated through the creation and use of tools.

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